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THE UNIVERSITY OF HONG KONG

AN EMPIRICAL STUDY OF THE IMPACT OF BUILT ENVIRONMENT ON CHILD DEVELOPMENT IN HONG KONG

A DISSERTATION SUBMITTED TO
THE FACULTY OF ARCHITECTURE
IN CANDIDACY FOR THE DEGREE OF
BACHELOR OF SCIENCE IN SURVEYING

DEPARTMENT OF REAL ESTATE AND CONSTRUCTION

BY
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HONG KONG
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Declaration

I declare that this dissertation represents my own work, except where due acknowledgement is made, and that it has not been previously included in a thesis, dissertation or report submitted to this University or to any other institution for a degree, diploma or other qualification.

Signed: _____

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Date: 12 APRIL 2006

ABSTRACT

The impact of the built environment on child development has been discussed around the world. Hong Kong, as a cosmopolitan city, is apparently lagged behind. This study aims at identifying and investigating the major determinants of built environment having effects on child development in Hong Kong.

Previous literatures on the relationships between built environment and child development are reviewed. Through the review of literatures and real-life observations, a set of determinants of the built environment in relation to child development is identified. Multiple linear regression analysis is adopted to examine the relationships between the child development and the determinants of built environment. The data used in the model is collected from questionnaires. Empirical results reveal that built environment, neighborhood and community do contribute in the process of child development within the context of Hong Kong. To achieve one of the objectives of this study, implications and recommendations are given to provide insights for urban planning stakeholders including the government, developers, surveyors and other professionals in providing favorable built environment for our children.

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Third, I would like to give special thanks to all my friends and studio groupmates for their continuous support and encouragement. Heartfelt thanks must be given to my family for their love and tolerance over the time spent on this dissertation.

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CHAPTER 1 – INTRODUCTION

1.1 – Background

Children are valuable assets of every society. They provide future leaders and workforce. At the transitional stage between childhood and adulthood, care and encouragement should be dedicated to children to assist them in developing into mature, responsible and contributing citizens. Recognizing the importance of children and their needs, all members in the society has vastly invested on them. The government, families, schools, voluntary agencies, child and youth care organizations, and various individuals in the society including young people themselves actively engage in devising urban policies and providing facilities in relation to child development.

The principles and ideals on child development provided by Charter for Youth published by Home Affairs Bureau (2005) state that children should be respected:

they deserve love, care in the family and community, sound physical and mental health, shelter, food, education, work, culture and recreation. Child development is the natural process of growing up and developing one's capacities in positive ways. This process takes place in the context of the family, the peer group, the school, the built environment, the neighborhood and the community.

The impact of the built environment, neighborhood and community on the developmental process of children has been extensively discussed by previous literatures around the world. However, relatively less attention has been paid to the studies of this area in Hong Kong. The importance of investigating the impact of built environment on child development should be stressed to furnish the government, urban planners, developers and all members in the society with insights to create a better city for our children.

1.2 – Objectives of the Study

The objectives of this study are formulated and summarized as follows:

1. To examine the relationship between built environment and child development
2. To identify the major determinants of built environment affecting child development in Hong Kong
3. To identify the relationship between the determinants of built environment and child development

1.3 – Outline of the Study

A review of relevant literatures on built environment and child development will be given to assist the readers in understanding the foundation of this study. Based on inspiration given by previous studies and the genuine situations in Hong Kong, major determinants of built environment affecting child development will be identified and defined. Hypotheses will be set and a multiple linear regression model will be constructed to examine the relationships between the set of selected and well-defined determinants of built environment and child development to test the hypotheses. The data used in the model is collected from questionnaires conducted by the author. The

empirical results will be discussed and analyzed to examine the significance and magnitude of the effects of the variables on child development. Implications and recommendations will be given to concerned parties based on the results. This study will be concluded at last with a summary of findings and implications as well as limitations of this study.

This study consists of six chapters. Chapter 1 is the introduction. Background, objectives, and outline of this study are specified.

Chapter 2 is literature review. Literatures about the background of built environment and child development, how they interact with each other and the major determinants affecting child development are given.

Chapter 3 comprises of hypotheses and research methodology adopted in this study. Hypotheses are given based on previous literatures and real-life situations in Hong Kong. The regression analysis technique, and design and rationale of the questionnaire are introduced as well.

Chapter 4 is an overview of the regression model. The variables incorporated in the model are identified and quantified. Their expected signs of effects are also discussed.

Chapter 5 presents the empirical results of the model and provides discussions, implications and recommendations to readers. The descriptive statistics of the data are first given. It is followed by a comprehensive analysis of the results. The implications of the results are discussed with recommendations.

Chapter 6 is conclusion which summarizes the findings and implications of this study. The limitations of this study and further research areas are suggested.

CHAPTER 2 – LITERATURE REVIEW

2.1 - The Great Transformation of Built Environment

Before investigating the relationship between built environment and child development, a preliminary background of how the built environment developed and its effect on human life should first be discussed. There are quite a number of literatures describing how the transformation of the built environment establishes globally.

Gutenschwager (1995) suggests that built environment is not a single entity which has been changing dramatically at all level. According to the United Nations Statistics Division (2003), the world population has a significant increase over the past 5 decades.

Year	*Mid-year Population Estimates (millions)*	*Growth in percentage (%)*
1950	2502	-
1960	3024	20.0
1970	3697	22.3
1980	4442	20.2
1990	5280	18.9
2000	6086	15.3
2003	6314	3.7

Figure 1.1 – Mid-year World Population from 1950 to 2003

Source: United Nations Statistics Division (2003 website)

The unprecedented increase in the world's population is now beginning to alter the built environment of the world. And it is developed in ways that are not yet comprehended by most of mankind and certainly not encompassed by any effective world-wide institutions designed to manage these changes (Gutenschwager, 1995). Malone (2001) affirms that the future is unavoidably urban. Urbanization is the only way most governments could ever attempt to provide the resources to cater for the population growth. But rapid urban growth creates huge imbalances between the available resources and the needs of the population.

2.2 – Impacts of Urbanization on Human Life

2.2.1 – Why People Live in Urban Cities

Some researchers portray the phenomenon that people live in urban area is attributable to the growing recognition and appreciation of the positive impact of urbanization. Higgins (1968) notes that growth in the size of the urban area can attain economic of scale in the provision of services such as infrastructure, such as road, drainage, service, and other community facilities such as hospital and school. These services are limited in provision for rural area or small town.

Michelson and Levine (1979) explain that the population in urban area is expected to be heterogeneous in cultural, socio-economic, family composition, age distribution and lifestyle. As pointed out by Churchman (1999), the densities in urban area are usually greater and this has implications for several aspects. The number, variety and quality of public and private services will potentially be greater in terms of cultural, commercial, recreational, health, educational, psychological support, religious and municipal services.

In addition, urban areas often have the tendency of agglomeration of basic services, such as water, electricity, sewage and communication which are provided at higher level than in rural areas. This notion is reinforced by Higgins (1968) that the distances within the neighborhood, or within other parts of the city, may be shorter, facilitating opportunities to reach the available resources. The diversity in the people who present in urban areas offers opportunities for meeting different kinds of people and finding those who match one's interests and preferences. Gehl (1996) recognizes the benefits of urbanization that the variety of stimuli of various sorts including sensory, cognitive, social and emotional is greater in cities than in other kinds of settlements.

To conclude, urbanization can improve the quality of human life and benefit the economic and social development of the urban cities.

2.2.2 – How Urbanization Alters Built Environment

With the world's largest cities growing by one million people per week, the United Nations estimates that the world's infrastructures will need to accommodate 4 billion people in 2025 (UNCHS, 1996). Malone (2001) warns that if cities don't develop in

sustainable ways, the impact of this population growth will be the continuance of urban slums.

As urban size expands, one of the most serious problems caused by urbanization is environmental problem. Gutenschwager (1995) explains that compounding the environmental problems of this rapid population growth is a dramatic shift in its location. People are migrating from small-scale sparsely settled rural environments to highly concentrated urban industrial environments. The built environment is increasingly a concentrated urban.

Gutenschwager (1995) further elaborates that the new built environment has arisen along with the rise of industrial capitalism. The free market principles determine that land and buildings are arranged according to the structural requirements of capitalism, i.e. investment for profit. One of the most serious effects of the free market system is the huge disparities of wealth within and among the world's cities. This has resulted in a series of severe problems, most often regarded as urban crisis. Despite the profits made, these problems indeed do harms on human life.

2.3 - Implication of Built Environment on Child Development

In advance of addressing the implication of the built environment on child development, the relevant characteristics of childhood should be discussed.

2.3.1 – Characteristics of Childhood

With reference to Aries (1962), in the Middle Ages, children in Western Europe were seen as small adults, rather than as conceptually different from their parents and consequently no special provisions were made for them. Once children could demonstrate certain competencies such as reason, concentration and strength, they were given what are considered 'adult' roles and responsibilities.

Valentine (1997) puts forward the view that the conception of a 'universal' childhood is emerged in 20th century. Children are temporally segregated from the adult world and childhood is a happy, free time, responsibilities lacking stage when children are imagined as innocent, incompetent and vulnerably dependent on their parents.

Churchman (2003) recommends that children refer to a heterogeneous aggregation and distinctions need to be made between countries and within countries, between different ages or developmental stages, between cultural groups, socio-economic groups and children of different health status, between different parts within a country, and between urban and rural settlements. United Nations (2006) defines children as every human below the ages of 18 in Convention on the Rights of the Child (CRC). And youth, as widely used to describe young people from the ages of 15 to 25, is partially overlapping. The definition of children given by Cairney (2005) is a period of responsibility-free dependence. Dependence refers to the fact that children spend more time at home in close proximity to their parents.

Cairney (2005) justifies that as children grow, their dependence on the built environment and parents begins to shift. In the early stages of childhood (ages 12 to 14 years old), children are still fairly dependent on the family and the built environment. However, as children progress through childhood into the middle and late teen years, they are increasingly less dependent on the primary caregiver. Moreover, the older children are also apt to spend more time outside the home with peers, both at school and in recreational activities. Thus the influence of the built environment and the social environment becomes significant for older children. According to Michelson and Levine (1979), the characteristics of built environment

become more important as children grow. During earlier years, they are more dependent upon adults, more tied to the neighborhood since they only go to other parts of the city accompanied by adults. At later stage when they can be relatively independent, they should be able to expand their use of the environment beyond the neighborhood alone, and thus reap more benefits from the city and the social environment.

Piaget (1956) views human cognitive development as a specific form of biological adaptation of a complex organism to a complex environment. In Piaget's theory of cognitive development (Piaget, 1952), four major stages of cognitive development are identified:

Stage 1: Sensorimotor period – birth to age 2

Stage 2: Preoperational period – ages 2 to 7

Stage 3: Concrete operational period – ages 7 to 11

Stage 4: Formal operational period – ages 11 onward

Piaget (1956) regards his age norms as approximations and acknowledged that transitional ages may vary. In view of children actively exploring the world around them, the interaction with the environment gradually alters their way of thinking. In

the context related to spatial behavior, the children's world expands to include the neighborhood and school in stage two and three. Children in these stages develop abstract notions of social roles and their spatial coordinates as they begin to understand the surroundings and learn to satisfy their needs in a larger environment. In stage four, children are ready to explore and understand the world beyond neighborhood and school to the city and world level.

2.3.2 – Cities and Child Development

Camstra (1997) declares the urban environment is not the most suitable environment for a child to grow up. As cities are crowded, polluted and hectic, the urban environment is seen as a less favorable living environment for children as well as grownups.

Malone (2001) gives a strong support that the worldwide impact of urbanization, industrialization, population growth, poverty, environmental degradation, crime and war and constant dumping of toxic waste into the atmosphere, is changing the opportunity for children to participate safely and freely in urban life. Gehl (1996) concerns there will be a lack of open spaces and of natural areas. Particularly, the noise level in parts of the city is likely to be high.

As suggested by Gutenschwager (1995), the crisis-ridden built environment is the setting for child development and growth. Unfortunately, it is hard to see how this environment will be improved much in the coming century for most of the world's population. This is not to say that nothing can be done, but it is important to realize the seriousness of the problems. The greatest challenge is to create a sense of security in such a chaotic environment.

Malone (2001) states that ideally towns and cities should be the place where children can socialize, observe and learn about how the society functions as well as to contribute to the cultural fabric of a community. They should also be sites where they find refuge, discover nature and find tolerant and caring adults who support them. This idea is braced by Churchman (2003) who suggests the residential neighborhood is a part of the city that is mostly likely to have a place for children.

As mentioned by Stokols (1976), the negative effects are most likely to occur in the individual's primary environment. A primary environment is where one spends a great deal of time and where one has important personal relationships. Examples of primary environments include the home, the workplace, school, and child care. People spend less time in secondary environments, and interpersonal relations are more

transitory and impersonal. Elevators, sports stadiums, and public transportation are examples of secondary environments.

According to Maxwell (2003), the primary environment is defined as settings where a person spends a great deal of time and establishes important relationships. For children, the home, school and day-care centres are primary environments which especially have critical effects. When there is a source of stress such as chronic noise or crowding in the primary environment, it is more likely to have negative effects on the individual than if it happens in a transitory or secondary environment such as a bus or stadium.

On the other hand, Bronfenbrenner (2005) postulates a theory that primary environments do not function independently of each other. Instead, they form a collaborative network of environmental experiences. This collaborative network of primary environments experiences supports and inhibits children's social development and development of personality. As supported by Maxwell (2003), it is believed that communities shape children's development. The relationship between the built environment and child's self-identity, self-esteem, and academic performance is identified. If children are given the right start, fewer developmental problems will develop later on.

Beck (1996) describes that because children are the most vulnerable to environmental and social degradation both in terms of likelihood of personal harm and the constraints these place on their capacity to reach their fullest potential, they are at greatest risk. An example is given by Spencer and Woolly (2000) that the impact of danger of violence from adults, other children and motorized traffic on child development may be significant.

Specifically, Michelson and Roberts (1979) recognize the problem of air pollution which is more serious for children than for adults. They explain children are usually more active out of doors than adults. In the course of play, children are frequently exposed to dirt and pollutants and thus children are more likely to breathe in polluted environment. Therefore, the built environment will affect children more profoundly then other members in the community (Malone, 2001). Churchman (2003) puts forward the view that children inherently have the right to enjoy a better environment. Their future and the future of our societies will be favored provided the children live in desirable environments in the broadest possible sense.

2.4 – Children's Voice

2.4.1 - The Needs of our Children

There is a global trend of recognizing the importance of the needs of the children. The Independent Commission on Population and Quality of Life (1996) advocates that a decent standard of living for all requires simultaneous attention to the carrying capacity of the world and the caring capacity of society. Children stand at the heart of changes. They have the longest-term investment in the protection of the environment and the creation of sustainable settlements. The investments in their care will benefit from the longest-term returns to children as well as to the society.

In Greater Johannesburg, Kruger and Chawla (2002) summarize the findings of a four-site study of children's needs and priorities. It represents the voices of 10 to 14-year-old children from four diverse but representative areas of the city. For each of the areas, boys and girls describe their use of their local environments, the places they value or fear, the problems they face and their own priorities for making Johannesburg a better city. The children's experiences and recommendations are shared through a report to the Greater Johannesburg Metropolitan Council and the Mayor's office. Children participating in this programme report that having their ideas

and viewpoints genuinely listened to has increased their self-confidence and bolstered their self-esteem.

In Northern Sweden, Alberby (2000) investigates the thoughts of children and young people about the environment in the municipal area. Their thoughts are made apparent with the aid of creative activity in the form of drawings combined with subsequent oral comments. The data of the study comprises of empirical materials consisting of drawings and graphics produced by 109 children and young people from ages of 7 to 16. The drawings are analyzed in detail and eventually four different themes of the built environment emerged:

1. Thoughts which focus on the good world
2. Thoughts which focus on the bad world
3. Thoughts which focus on the dialectics between the good and the bad world
4. Thoughts which focus on symbols and actions protecting the environment

Approximately 50% of all the drawings are placed in the theme of ‘the good world’. The result also shows that this thought is more common within the three youngest age groups (7, 10 and 13) compared with the oldest age group (16). The difference might be explained by the fact that the thinking process of the youngest

children derives from their own concrete reality of the neighborhood, while that of the oldest age group also derives from a comprehensive realistic global view.

According to the study by Skelton and Valentine (1998), it reveals that children and youth have nearly the same wishes no matter where they grow up in the world:

1. They want clean water and enough food to eat
2. They want to be healthy and the space to learn, develop and play
3. They want friends and family who love and care for them
4. They want to participate in community life and be valued
5. They want to collaborate with adults to make the world a better place for all
6. They want peace and safety from threats of violence
7. They want access to a clean environment where they can connect with nature
8. They want to be listened to and their views taken seriously

However, the genuine needs of children on the built environment are often ignored by the decision makers of urban planning. Spencer and Woolley (2000) blame that adults in general, politicians, planners and city managers in particular too often

ignore the fact that the city is indeed relevant to lives of children and can have much to offer them.

Bettleheim (1987) introduces the reasons of the ignorance that adults do not understand the developmental importance of various experiences, such as autonomous plays, for children. They do not differentiate by age, despite the differences between children in competencies, activities and responsibilities. For some adults, the attitude is that childhood is a passing phase and thus do not need to be considered separately. Adults do not intuitively understand what elements of the environment are important for children. And the research available is not readily accessible either to the decision makers or to the general public. Spencer and Woolley (2000) further explains that children are usually not given an opportunity to say what they want and need, perhaps because they do not vote and have no political power.

2.4.2 – Children Participation in Urban Planning Decision Making

Globally, there is growing appreciation of the need to recognize children as equal citizens to adults. Rosenbaum and Newell (1991) points out that the United Kingdom signs the United Nations Declaration of Children's Rights, a move which comes hard on the heels of the Children's Act of 1989 which granted children more autonomous

decision-making powers. The principles of the Convention of the Rights of the Child (CRC) reinforces the responsibility of the States Parties since it challenges them to uphold the children's rights to live in a safe, clean and healthy environment and to engage in free play, leisure and recreation in the environment. According to CRC, children's well being and quality of life are the ultimate indicators of a desirable environment, proper governance and sustainable development (UNICEF, 1997).

Principle 21 of the Rio Declaration published by United Nations (1992) clearly emphasizes the role of children in sustainable development. It states that the creativity, ideals and courage of the children of the world should be mobilized to forge a global partnership in order to achieve sustainable development and ensure a better future for all. United Nations (1992) affirms the involvement of children in built environment and urban development decision-making and in the implementation of urban development programmes is critical to long term success of Agenda 21. Presented by UNICEF (1997) at the United Nations Conference on Human Settlements at Istanbul in 1996, the Children's Rights and Habitat Report draws attention to the important role children have in sustainable development. It is stated that children have a special interest in the creation of sustainable human settlements that will support long and fulfilling lives for themselves and future generations. They

require opportunities to participate and contribute to a sustainable urban future (UNICEF, 1997).

The Convention of the Rights of the Child (CRC) by the United Nations (2006) contains 54 Articles, most of which address governments' obligations to protect children from exploitation or abuse and to provide for their basic needs. The CRC contained four Articles that relate directly to rights to participation as well as a number of Articles relevant to the quality of the living environment. The participation-related Articles address children's rights to express their views freely in all matters that affect them (Article 12), rights to freedom of expression and information (Article 13), rights to thought, conscience and religion (Article 14) and rights to association and peaceful assembly (Article 15). The guidelines for the implementation of the Convention explicitly advise these rights apply to the quality of the built environment.

As explained by Chawla (2002), the Articles challenge governments and other agents in human settlement development to perceive children not only as small and dependent members of society but, simultaneously, as potentially active citizens who already have ideas and energies to contribute. In order to comply with the spirit of these Articles, governments need to facilitate the development of human settlements

that fosters children's health and survival and their participation in the social and cultural life of their communities. Likewise, they need to give children a voice in decisions that affect the quality of their natural and built environment.

Driskell (2002) introduces a prominent urban planner Kevin Lynch who launched an international project of activities called Growing up in Cities. The project was first implemented in the 1970s and revived in the 1990s. It continues to spread around the world. It is an action research that uses a variety of methods to engage children and young people in evaluating their communities, determining their priorities for change in environment, and helping to implement local improvements. The project initiates ongoing processes for community improvement in which children continue to participate.

Many researchers support children participation in urban development. Chawla (2002) recognizes because children have the largest future of any group in the society, they can direct policy making toward long-term planning. Societies' investment in children is the strongest reason for commitment to sustainable development. Beyond this, children are societies' bridge to the future. Through the participation in sustainable settlement planning, children can gain the attitudes and skills that they will need to ensure the protection of the environment across

generations. Children's rapidly developing bodies and minds must be nourished and protected in the immediate present. A failure to meet their needs will have long-term consequences. The longer the societies postpone investments in the well-being of children, the higher the costs for remediation become. And some forms of psychological and physical damages may be irreparable.

As reminded by Malone (2001), the relationship between sustainable development and children's lives is not just about adult's role as stewards and their capacity to act on behalf of the child. It is also about recognition of the capacity for children and youth to be authentic participants in planning, development and implementation processes. Maxwell (1996) appreciates children have the cognitive capacity to observe and respond to built surroundings. But it is noted that the attributes that children prefer in a built environment change as children age. Chawla (2002) suggests three main reasons for encouraging children's participation in development:

1. Children will learn formal skills of democratic citizenship in this way
2. Children are the best experts on local environmental conditions related to their own needs

3. Children will acquire a foundation for lifelong habits of environmental interest, concern and care

The above reasons are supported by Hart (1997) who emphasizes that children can learn active and responsible citizenship through opportunities to practice which it is not something they magically attain when they reach the legal voting age. Cooper-Marcus and Wendy (1986) assert that children are in fact the heaviest users of outdoor spaces. In their play and work, they often venture into areas that adults rarely use. Therefore, environmental planning can benefit from children's local knowledge. Bartlett et al. (1999) supports that work, when it is not exploitative, can also be a method which enable children to learn about their environment and feel a valued part of their societies. Through these informal interactions, children can also acquire lasting habits of environmental care.

Concerning the relationship between children and built environment, Chawla (2002) concludes that given children's relative lack of mobility and dependence on immediately accessible resources, they draw attention to environment at the community level. Small changes in the local environment may have a perpetual impact on children. Thus it is important not only to give children special consideration in planning and managing human settlements but also to incorporate children into

decision processes. In this way, adults can be sensitized to children's needs that they often overlook, and children can learn how to take an active and responsible role in caring for the environment.

2.5 – The Determinants of Built Environment in Child Development

Murray (1938) who devotes himself in researches on the theory of personality suggests that if the environment has a potentially beneficial effect, individuals typically approach the environment and attempt to interact with it. In contrast, if the environment has a potentially harmful effect, individuals attempt to prevent its occurrence by avoiding the environment and defending themselves against it.

In view of Murray's theory (1938), the environment should be developed in the sense that enriching children with all potentials to mature. Weinstein and David (1987) subsequently generalize all built environments for children should serve certain common functions with respect to child development:

1. To foster personal identity
2. To encourage the development of competence

3. To provide opportunities for growth
4. To promote a sense of security and trust
5. To allow both social interaction and privacy

They regard environments as the conditions, forces, and external stimuli that impinge on individuals. These forces, which may be physical or social as well as intellectual, provide a network that surrounds, engulfs, and plays on the individuals. The total context surrounding an individual can be defined as being composed of a number of sub-environments.

Some previous studies investigate the impact of a number of characteristics concerning the built environment on child development. A thorough review of relevant literatures which gives essential insights for this study is provided.

2.5.1 – The Availability and Accessibility of Public Utilities

Berg and Medrich (1980) explain the kind of zoning practiced and how much it limits the heterogeneity in the environment will affect the degree to which children are exposed to the variety that the city has to offer. The location of the city centre and

various resources in the neighborhoods determine the children's ability to make use of these resources. In other words, it represents how far it is from one's neighborhood to the various resources and whether it is possible to get to them.

Woolley et al. (1999b) confirms the importance of the existence of the needed services such as theatre, cinema, museums, zoos, discotheques, community centres, sports areas, shopping centres, counseling services and police protection. In addition, the appropriateness of the services and activities for the children of different ages and inclinations do influence whether the children can take advantage of what the city offers.

In addition, Van Vliet (1983) affirms that the presence of public transportation and the degree which it can take children to where they want to go are critical factors, particular for the children who do not wish to be dependent on adults.

Regarding the accessibility of the public utilities, Weeks (2004) classifies accessibility into three types which are geographical, physical and psychological accessibility. Geographic access refers to locations which are readily reached, for example, through proximity to public transport. Physical access refers to the capacity to enter the building, for example, in a wheelchair, or if aged or disabled and walking

with a stick. This implies the unsuitability of stairs and steps, and also requires wheelchair accessible curbs around the building and toilets and rooms internally. Psychological access refers to an absence of features which might stimulate stigma or, as in the case of security guards, a sense of fear about the entry.

As mentioned by Gehl (1996), the distance to services within the neighborhood and whether they can be reached by bicycle or on foot have high relation to the degree to which children can reach these services on their own. These services provide children with not only basic needs but also the opportunity to observe and explore the community. This explanation of physical accessibility is a valuable inspiration for urban planners.

2.5.2 – The Provision of Public Spaces

Public spaces allow children to play, gather and learn. As suggested by abundant literatures, play is an essential activity for all children. Bettleheim (1987) states play is the major medium for achieving physical, perceptual, cognitive, social and emotional developmental goals. Many adults do not understand the significance of play and therefore do not attach importance to the environments that can facilitate play. Vickerius and Sandberg (2004) agree that the ecology of human development is

significant for play as play is an activity which the children can actively contribute to create relations with other people and develop the child's language, thoughts and feelings. In relationships the children can meet different kinds of roles which can be used in play.

However, McKendrick et al. (2000) worry that spontaneous unregulated play in neighborhood spaces particularly in affluent areas of cities is increasingly becoming a thing of the past. Children are now encouraged to only participate in regulated play environments in their homes, friend's houses and commercial facilities under parental supervision. It is because this type of regulatory practice can help to 'protect' their children from becoming victims of environmental hazards. However, it has long term consequences for their social and emotional growth.

Churchman (2003) summarizes the environmental characteristics which are important for outdoor play spaces for children from some published researches on this topic:

1. The spaces are close to home and close to the entrance that is used by adults
2. There are sufficient numbers of children within a reasonable radius
3. The spaces are easily accessible, both visually and physically

4. They are close to other activities, particularly those of adults. On the whole, the children want to feel part of the world, and not be relegated to some fenced off or separated area
5. They have sufficient open space, so that the children are able to undertake all sorts of activities, including ball games, bicycle riding, etc.;
6. They offer a variety of opportunities for different types of play, so as to accommodate the interests and abilities of different ages and different children;
7. The area is safe in terms of traffic safety and of the equipment and the ground surfaces, and in terms of safety from adults;
8. The area is comfortable climatically for as much of the year as possible;
9. There is consideration for the adults, both those who may be supervising the younger children and need a comfortable place to sit, and those living close to the play areas, who do not want children peering in their windows or interfering with their access to their dwellings.

It should be noted that these characteristics cannot be achieved in the guise of playgrounds which are the common solutions proposed by adults. In lieu of this, they require that all public open spaces of the residential environment should be planned and designed in a way that children can discover rather simply play in these areas. In this sense, playgrounds form only a small part of the open-space system.

2.5.3 – The Housing Density

Maxwell (2003) warns that the consequence of chronic exposure to high density for children has generally been documented as negative. They include increased aggression and hostility, poor academic performance, poor family social interaction, and social withdrawal.

According to Maxwell (2003), in preschool/child care settings, less space per child is associated with less interaction between children, more time spent in solitary play and less gross motor play. Decreasing the amount of space per child from 25 to 15 square feet is accompanied by increased aggressive behavior, more parallel play in large group, and less group play.

Rodin (1976) gives one explanation for why crowding is harmful to children. The loss of control over social interactions that frequently accompanies high-density living should be serious considered. A research to compare elementary school-aged children living under high- and low-density conditions on age-appropriate indices of helplessness is conducted. It is revealed that uncontrollable social interactions that occur under crowded living conditions might lead to a loss of self-efficacy in children and be manifested by elevated susceptibility to learned helplessness.

In United States, Maxwell (2003) examines whether home density (the number of people living in the child's home) affects children's classroom behavior and academic performance. 73 children of ages of 8 to 10 from two schools in urban area are invited to complete a reading test and a scale measuring stressful events (Lewis Feel Bad Scale). The children are asked the number of rooms in their homes and the number of people they live with. Besides, they are asked whether the children feel disturbed at homes while doing homework and reading. Regression analysis indicates that there is a main effect of household density on the reading measure and word identification such that children from the more crowded homes score lower on this measure. Children in crowded homes are more likely to feel badly and children who have their own bedroom are more likely to feel they have a place to be by themselves, feel they can be alone when they want, and feel less crowded at home. It is concluded that there is a negative effect of household crowding on academic performance.

In New York City, Evans et al. (2001a) conduct a cognitive development research to test whether residential crowding (people per room) is related to psychological health among children of ages of 9 to 11 in both urban and rural areas. The psychological health of the sample of children is measured by a standardized

instrument, the Rutter Child Behavior Questionnaire. Their findings indicate a positive relation between household density and psychological symptoms. Children living in more crowded homes are less likely to persist when they confront with a challenging puzzle. Particularly, they find boys, but not girls, appear to suffer greater psychological distress in relation to residential crowding. At a given level of residential density, urban children suffer greater socio-emotional distress. They explain urban children are exposed to more intense levels of stressors (e.g. more crowding) and to a broader array of multiple stressors (e.g. racism, community violence, concentrated neighborhood decay, noise and pollution). They deduce that lower academic achievement levels and less persistence on academic tasks are associated with children living in crowded homes.

In conclusion, household density does seem to affect both psychological well-being and academic performance of children.

2.5.4 – The Type of Accommodation

Richman (1977) asserts that children who live in high-rise apartments suffer negative effects related to restricted play opportunities which result in isolation in the residential unit. In United States, Wilner et al. (1962) compare two groups of African American families living in public housing. A half of the sample remains in their original housing while another half moves to newly renovated public housing. Parental psychological health is found to be increased. Social relations with neighbors are better established. And children's school performance shows improvement among those who move in comparison to those who remain.

In New York City, Evans et al. (2001b) assess the relationship between built environment and children's socio-emotional health in several respects. They collect data on housing quality and children's socio-emotional well-being from 277 children who are averagely 9.12 years old. The instrument of measuring the housing quality includes structural quality, privacy, indoor climate, hazards, cleanliness/clutter and children's resources. In addition, a standardized index of children's psychological health, the Rutter Children's Behavior Questionnaire, is employed to assess their psychological health. Regression analysis is employed to examine the relations between housing quality and two measures of socio-emotional well-being. It is found that increased housing quality is associated with fewer behavioral problems. They

conclude children living in lower-quality housing, independent of household income, have more apparent symptoms of psychological distress indicated by a standardized index. Poor quality housing can also directly affect children's self-esteem, particularly as they interface with peers.

In United Kingdom, Ellaway and Macintyre (1998) reveal in their study that the rental accommodations are more likely to be overcrowded, have poor environmental quality (cold, damp, drafty), and be in need of repairs. All of which have been shown to influence child health. The negative effect of housing tenure on children's well-being results from great exposure to suboptimal housing conditions such as overcrowding and home in need of repairs which tend to be more prevalent in rental housing. Boyle (2002) supports there is impact of home ownership and housing conditions on child health. The quality of the housing environment in rental versus owned homes may account for the negative impact of housing tenure on child health.

Green and White (1997) give an explanation for why housing tenure affects children's well-being is related to parenting practices. They speculate that, on average, homeowners are more positively engaged than renters in the parenting of their children because many of the skills required to manage a home (budgeting, planning, and problem solving) cross over into other domains, such as parenting behaviors.

Cairney (2005) further elaborates this explanation that homeowners are more engaged in the regulation of their child's behavior and the behavior of other children in the community than parents who do not own their homes. It is because they are more interested in protecting their investment. Thus positive parenting practices explain the emotional and behavioral health advantages of children in family-owned homes more than that of children living in rental accommodations.

Evans et al. (2000) give the third explanation to the effects of housing tenure to child development focusing on parental health. They state that homeownership and housing quality are both associated with mental well-being in adults. If the primary caregiver is distressed because of his or her housing circumstances, this can also negatively affect the child who is in close contact with this person. Billings and Moos (1983) have already demonstrated a link between parental depression and emotional and behavioral problems in both children and adolescents.

According to a study by Haurin et al. (2002), they find that the children of homeowners achieve higher levels of cognitive and have fewer behavior problems. The longer the parents own a home, the greater their children's cognition is and the less severe behavior problems are. They suggest two mechanisms to explain how homeownership might affect children. The first one is the stronger investment

incentive of owners compared with renters. Another is greater geographic stability. The investment incentive should result in a homeowner having a better home environment. Also, children will be exposed to a more stable school environment.

Cairney (2005) points out that if the residential environment is a risk factor for poor health outcomes, then greater exposure to the home environment places children at greater risk for emotional and behavioral problems. Young children are more likely to be homebound and therefore more likely to be exposed to overcrowding, noise and draftiness as well as their parents' stress.

In Canada, Cairney (2005) studies the relationship between age, housing tenure, and mental well-being during adolescents by setting a hypothesis that the effect of housing tenure in mental health is significant among younger adolescents (ages of 12 to 14 years old) but not significant among older adolescents (ages of 15 to 19 years old). Among children, ages of 12 to 14 years old, distress is higher among adolescents who live in rental dwellings. The prevalence of depression is approximately three times higher among adolescents who live in rental dwellings as compared to those who live in homes owned by their caregivers. Thus for children, age becomes a critical moderating variable because time spent in the home will change as children grow. Also, the results support that young adolescents are more

vulnerable to the effects of housing tenure than older adolescents presumably because the former spends more time in the home environment than the latter. Given the importance of early childhood physical and social environment on later development, it is critical to identify environmental risk factors that affect child well-being and development.

2.5.5 – The Degree of Autonomy in Exploring the Environment

Some scholars demonstrate the autonomy of exploring the environment is beneficial to child development. Huttenmoser (1995) holds the view that children who can function on their own can expand their environmental capabilities in terms of their ability to understand the environment. Independent experience in environment increases these capabilities. The more complex the environment is, the more capabilities they are required and the more abilities they can learn.

Piaget (1956) points out that the independent mobility in environment is essential for children's cognitive development. Michelson and Levine (1979) elaborate that the children are able to expand their horizons through their contact with the variety of people, environments, activities, resources and stimuli that the city offers. This idea is supported by Lang and Deitz (1990) that the children can expand their experience with autonomy and independence. It allows them to notice they are

capable of functioning on their own. It does contribute to their feelings of self-confidence and self-esteem. Churchman (2003) concludes that when children cannot function and take advantage of what the city has to offer on their own, they will have fewer experiences and fewer challenges, and less variety in their lives to some extent.

However, there are restrictions on children's autonomous exploration of the environment. Lee and Rowe (1994) put forward the view that one of the more critical physical aspects of the built environment determining the autonomy of children in expanding their environmental capabilities is the road system and the degree to which it represents a danger to children. Camstra (1997) supports community safety plays an undeniable role in restricting children's mobility and autonomous plays. An explanation is given by Woolley et al. (1999a) that the perceived level of safety within public environments and the means used to ensure it will affect the attitudes of both parents and adults towards the use of the city by children.

In New York City, Maxwell (1996) interviews 45 elementary and middle school children of ages of 8 to 13. The children are asked what they like and dislike about their homes, neighborhoods, and schools. It discovers that the privacy and a sense that they can control are important to children from their perspectives. Living in a safe neighborhood, being able to cross the street without adult assistance, and having facilities such as stores, movie theaters and playgrounds to visit help children to develop a sense of self and a sense of confidence about the environment.

2.5.6 – Community Identity and Involvement

Lynch (1977) recommends children should be living in places that have a clear social and spatial identity and places where they can understand and take pride in. They should have a role to play in community. They should have particular functions to perform and particular places for which they are at least in part responsible.

Camstra (1997) suggests that all essential elements of the process of growing up are readily available in community. Taking initiatives, acquiring social and practical skills in the informal setting that their local neighborhood and community provides, exercising their minds and bodies in self-directed activity, developing a sense of adventure, gaining self-esteem, learning from direct experience how to avoid risk and cope with unexpected situations by exposure to mild forms of them and getting up to mischief and suffering the troubles which they create will deepen their development.

The benefits of involving in community is explained by Maxwell (1996) who believes that one of the key things that children need to do is learn how to be adults. One of the ways they can do that is by being in a community and interacting with adults other than their parents in daily situations rather than frequently being

segregated with their peers. Children need to test roles and ways of interacting within groups. Also, they need to participate in those activities in safe places as well as in places where they can observe how adults interact. Li (2002) recognizes the specific role of public open spaces in helping children to participate in community. Public spaces have an important function of drawing residents in community together and should cater for the needs of every sector of members in the neighborhood. In this sense, the provision of public open spaces is important for furnish the children with the opportunities to observe, interact with and learn from adults.

As reinstated by Camstra (1997), a sense of community must be a planning goal. Spaces for social interaction are important for children. It should be recognized that the role of the urban planner here is somewhat limited. If it is not possible to determine human behavior merely by rearranging the environment, however, certain arrangements of the built environment and urban facilities can facilitate children's community oriented behavior which is beneficial to child development.

2.5.7 – Implication of the Determinants

This chapter gives a comprehensive review of previous literatures on the characteristics of built environment and their possible impact on children. Planners, designers, builders and environmentalists have to be more concerned with children's genuine needs. Observation and research of children's need should be the indispensable parts of the design process of the built environment. The children should be asked to evaluate the existing environment and to participate in the design and construction of environment, specifically for those intended to provide for children.

Obviously, urban planners need to be aware of children's manifold needs of environmental experiences. Since children do not complain and stand up for their own interests because they do not know what they are missing, adults should be responsible for doing that. However, adults often put their own interests first. Therefore this study hopes to help adults realize that they have a collective responsibility for children.

CHAPTER 3 – HYPOTHESES & METHODOLOGY

3.1 – Introduction

This chapter presents the methodology utilized in this study. First, hypotheses will be set to facilitate the achievement of the aims of this study in chapter 3.2. Second, chapter 3.3 will explain the approach used for identification and analysis of the major determinants of child development concerning the built environment in Hong Kong. Chapter 3.4 will define the scope of study for this study. Chapter 3.5 will describe the rationale and the construction of questionnaire. The multiple regression technique and the statistical tool for constructing the built environment model will be introduced in Chapter 3.6.

3.2 – Hypotheses

Based on previous literatures and actual situation in Hong Kong, a set of determinants of built environment is identified. This study hypothesizes that the built environment, neighborhoods and communities do exert influences on child development. The sub-hypotheses of their effects on child development are summarized as the following five statements:

(I) The type of housing makes impact on child development

(II) The physical environment of accommodation does affect child development

(III) The accessibility of public utilities has influence on child development

(IV) Children's usage of public utilities has influence on child development

(V) Children's perception on built environment, neighborhood and community makes impact on child development

Each sub-hypothesis will be confirmed or refuted by testing with evidence supported by the collected data incorporated into the regression model.

3.3 – Selection of Methodology

As this study aims at examining the influence of the built environment on child development in Hong Kong, an appropriate size of the sample should be determined to collect data from a representative portion of the population so as to achieve higher significance of this study. Thus a quantitative approach is adopted to serve this purpose as it allows larger sample to be studied.

The research methodology adopted in previous studies studying the impact of the determinants of the built environment in child development would incorporate both the qualitative approach and the quantitative approach in order to enhance the significance of the studies. Ideally, a follow-up study should be incorporated to have a comprehensive study to observe and measure the gradual effects of the built environment on child development in various aspects. Also, home visits and interviews are conducted to obtain additional information and thus the limitations of the study can be reduced. However, the limited time and resources are the essential constraints for adopting this combined approach. Therefore, the best approach for this dissertation is the quantitative method, which makes use of questionnaires, with assistance of statistical tools.

3.4 – Scope of Study

As the aim of this study is to study the influence of the built environment on child development, a well-defined scope of study including the appropriate age groups and the determinants of built environment to be studied should first be given.

The targeted age groups adopted in the previous studies vary with regard to the targeted stages of childhood being studied. The following is the summary of the age groups being studied in previous studies.

Study	*Location*	*Age Group Being Studied*
Alberby (2000)	Northern Sweden	7 – 16
Cairney (2005)	Canada	12 – 14 & 15 – 19
Evans et al. (2001a)	New York City	9 – 11
Kruger and Chawla (2002)	Greater Johannesburg	10 – 14
Maxwell (1996)	New York City	8 – 13
Maxwell (2003)	United States	8 – 10

Table 3.1 – Summary of age group being studied in previous studies

The targeted age group is up to the researchers to decide after considering the unique characteristics of the children and the built environment in the country or city

being studied. Thus the targeted age group should represent a certain extent of uniqueness of the country or city.

In the context of Hong Kong, there is no standardized or generally adopted definition of the ages of children. In this study, the age-related definitions given by some of the literatures will not be adopted as it is subject to variations according to the unique characteristics of the countries. Instead, the idea given by Cairney (2005) will be adopted in this study. It is stated that the child is dependent on both the family and the built environment in the early stages of childhood. Under the provision of 9-year free and compulsory education which targets on children at the age of 6 – 14, a child will normally reach primary four at the age of 9 – 10 and start receiving secondary school education at the age of 11 – 12. The children in this stage are still dependent on their families and their home environment. In addition, the children in this stage will start exploring the neighborhood and developing their social network in the community.

In order to enhance the significance of this study, the age group selected should be consistent with the statistical data provided by the Census and Statistics Department, HKSAR. According to the Census and Statistical Department, HKSAR, the age groups concerning the childhood provided in the statistics are 0 – 4, 5 – 9, 10

– 14 and 15 – 19. For this study, the age group of 10 – 14 is the most suitable choice among them. Normally, the children of his age group are receiving the 9-year free and compulsory education ranging from primary four to secondary three. The variation with regard to the children's educational background can be limited and thus the significance of the sample can be maintained.

According to the Census and Statistics Department, the decline in the population of the age group of 10 – 14 is revealed in its percentage in the entire population.

Year	*Population of the age group of 10 – 14 ('000)*	*Percentage of the age group in the entire population (%)*
2005	422.6	6.1
2004	428.6	6.2
2003	433.7	6.4
2002	434.5	6.4
2001	430.1	6.4
2000	431.9	6.5
1999	429.8	6.5
1998	420.6	6.4
1997	424.2	6.5
1996	438.0	6.8

Figure 3.1 – The Population of Age 10 – 14 from 1996 to 2005 in Hong Kong

Source: Census and Statistics Department, HKSAR (2006 website)

The aging problem in Hong Kong is not the scope of study in this study. The statistics quoted is used to highlight the importance of studying the influence of the built environment on the children of which its population is shrinking in the past two decades. As the children, whose population implies the sustainability of the manpower of a country, are the most valuable assets, they deserve the greatest concern from the society.

3.5 - Rationale and Construction of Questionnaire

3.5.1 – Design of the Questionnaire

A bilingual questionnaire in both Chinese and English was prepared for data collection. The questionnaire was divided into four parts. For the first three parts of the questionnaire, the respondents must answer the questionnaires with regard to the situation at their ages of 10 to 14. In the first part of the questionnaire, there consisted of total eleven questions. They included the information of the physical environment of the respondents' accommodation including the type of accommodation, its floor level and usable floor area, the number of people and generations living in the

accommodation, the number of people sharing the bedroom and studying room, and the availability of sea view and mountain view.

In the second part, nine questions about the neighborhood were included. The traveling times (in minutes) between the respondents' accommodation and various public utilities including the nearest public library, youth centre, community centre, amenities centre, sport facility, open space, primary and secondary school and MTR/KCR station were asked. In addition, information about the respondents' usage (per month) of the public utilities was collected.

In the third part, the respondents were asked to rank their levels of agreement on 6 statements concerning the perception on various aspects of the physical and social environment of the built environment, neighborhood and community. A five-point ordinal scale from 1 to 5 (1 represented the respondent strongly disagreed with the statement, 5 represented the respondent strongly agreed with the statement) was used to help the respondents to express their views towards the statements.

In the last part of the questionnaire, the demographic statistics including gender of the respondents and the results of their first attempts of HKCEE were collected. A sample of the questionnaire was enclosed in Appendix I.

3.5.2 - Population and Sample

The questionnaires were distributed to the students in eight local universities, a number of local secondary schools, the Hong Kong Institute of Vocational Education (IVE) and the Hong Kong Academy for Performing Arts. Each individual is chosen entirely by chance and each member of the population has a known, but possibly non-equal, chance of being included in the sample. Data collection takes place during the period from February 13th, 2006 to March 13th, 2006.

There are two requisite criteria for eligible respondents of the questionnaire:

1. He / she must have attended HKCEE with six or more subjects in the same attempt
2. He / she must reside in Hong Kong at the age of 10 to 14

The population of the age group of 10 – 14 is 431,948 according to 2001 Population Census done by the Census and Statistics Department, HKSAR. The breakdown of the population is listed on next page:

District	*Gender*	*Population*	*%*	*Total*
Hong Kong Island	M	38,158	8.8 %	73,947
	F	35,789	8.3 %	
Kowloon	M	61,157	14.2 %	118,448
	F	57,291	13.3 %	
New Territories	M	123,190	28.5 %	239,553
	F	116,363	26.9 %	

Figure 3.2 – The Population of Age 10 – 14 by sex and broad area in 2001 in Hong Kong

Source: Census and Statistics Department, HKSAR (2006 website)

The demographic characteristics of the sample should be comparable to the above statistics. Thus the sample can effectively represent the population and thus the reliability of the results can be enhanced.

3.6 – Multiple Regression Analysis

In order to observe the interactions between child development and a number of major determinants of built environment, multiple regression analysis will be employed. Multiple Regression is a statistical method for studying the relationship between one single dependent variable and one or more independent variables.

To the purpose of this study, this statistical tool will be used to determine whether a particular independent variable in the set of defined independent variables really affects the dependent variable. In addition, the magnitude of the effects can also be estimated by Ordinary Least Squares (OLS) technique. That means the function will be estimated from a pool of data in a way that the sum of the squared prediction errors will be as small as possible.

The general expression of a multiple regression model is shown as follows:

$$Y = a + b_1X_1 + b_2X_2 + \ldots + b_kX_k$$

Where Y is the dependent variable;

a is the y-intercept (constant);

X_1, X_2, …, X_k are the 1^{st}, 2^{nd}, …, and k^{th} independent variables entered into the equation;

b_1, b_2, …, b_k are the slope associated with the 1^{st}, 2^{nd}, …, and k^{th} independent variables (which are also known as partial coefficients);

EViews[1], a computer software for manipulating statistical data, will be used for performing the regression analysis. To interpret the results generated by a multiple regression model and judge whether the results are statistically significant, the following statistical techniques must be given in advance.

3.6.1 – Coefficient of Determination (R^2)

The common expression of the coefficient of determination is R^2 which indicates the explanatory power of the independent variables on the dependent variable. It describes the proportion of the variation within the dependent variables observed can be accounted for the variations within the independent variables included in the model. The value of the coefficient of determination ranges from 0 to 1. If R^2 is equal to 1, it means the variation within the dependent variable is due to variations within the

[1] EViews Version 3.0 for Windows. Copyright© 1990-2000 Micorosoft Corp.

independent variables[2]. The greater the value of R^2 entails, theoretically, the higher the explanatory power of the independent variables on the dependent variable.

3.6.2 – F-statistic

F-statistic is a statistical technique to test the significance of the R^2 statistic. It is employed to test the null hypothesis that none of the independent variables helps to explain the variation within the dependent variable. If the probability of F-statistic is greater than the critical value determined by the confidence interval desired and the degree of freedom (i.e. the sample size less the number of dependent and independent variables), the null hypothesis is rejected.

3.6.3 – t-statistic

The t-statistic is employed to examine whether each independent variable has a significant effect on the dependent variable. If the t-statistic is greater than the critical value, the respective independent variable can be regarded as statistically significant.

[2] The value of R^2 increases as more independent variables are added to the model no matter whether they are significant. Although it is true that higher of the value of R^2 is better, there's no reason to reject a model because of small R^2. The value of R^2 is not the sole determinant of a 'good' model.

The results of this test can be shown by p-value. The significance of the independent variable increases when the p-value is approaching to zero.

3.6.4 – Partial Coefficient

The value of the partial coefficient will specify the marginal effect of the independent variable on the dependent variable, while holding other constant. The sign of the partial coefficient will indicate the direction of the relationship between the dependent variable and the independent variable.

CHAPTER 4 – EMPIRICAL MODEL OF BUILT ENVIRONMENT

4.1 – Introduction

This chapter aims at providing an overview of the empirical model for investigating the major determinants of built environment in relation to child development in Hong Kong. Chapter 4.2 will identify and quantify the dependent variable which represents the attainment of child development in Hong Kong. Chapter 4.3 will define and explain all independent variables incorporated in the model with reference to the previous similar studies and the unique characteristics of the built environment in Hong Kong. The model specification based on a linear regression equation will be given in Chapter 4.4. In addition, the expected signs of coefficients of the defined independent variables in the built environment model will be stated at the end of this chapter.

4.2 – Identification of Dependent Variable

Previous studies used to examine the attainment of child development in different aspects. Cairney (2005) tests the effect of housing tenure on child mental health. Evans et al. (2001b) study the relationship between built environment and child socio-emotional health. Evan et al. (2001a) conduct a research to test the impact of residential crowding on child psychological health. Maxwell (2003) investigates the effect of home density on child classroom behavior and academic performance. The wide diversity of aspects of child development gives the researchers much freedom to choose their research areas. For an undergraduate majoring in surveying, lack of professional knowledge and technique of conducting research concerning psychology or cognitive sciences is the essential limitation to investigate the child psychological or emotional health. Thus it is most suitable to investigate and observe the attainment of child development from an objective and widely-accepted perspective.

However, the attainment of child development can hardly be objectively measured as it is a sustained developmental process instead of an instantaneous action and reaction process. As this study aims at studying whether the determinants of the built environment influence child development and, if any, the extent and significance of those effects, it is essential to construct a relatively objective measurement of the attainment of child development.

In context of Hong Kong, Hong Kong Certificate of Education Examination (HKCEE), which is a public examination conducted by Hong Kong Examinations and Assessment Authority, is normally taken by students at the end of their five-year secondary education. Most day school candidates take 7 to 8 subjects in the HKCEE. The same standards are applied in marking and grading in all subjects. The results of the HKCEE are expressed in terms of six grades A – F, of which grade A is the highest and F the lowest. The HKCEE is widely recognized in Hong Kong as a basic indicator for both measuring the academic attainment of the students and employment purposes. To serve the purpose of this study, there are two reasons to use HKCEE to measure child development. Firstly, HKCEE is an important benchmark of the future success of children as well as a reliable check point of child development. Secondly, subject to limitation on resources, this study has to employ HKCEE results to be the dependent variable which is a suitable quantity for measuring child development.

The respondents were asked to fill in their total grade points[3] of the best six subjects obtained in HKCEE. The total grade point calculated will be ranging from the minimum of 0 to the maximum of 30. If the respondents did attend HKCEE more than once, they were asked to fill in the results of their first attempts. The results of

[3] The grade point is calculated according to the grades obtained in the subjects (A = 5; B = 4; C = 3; D = 2; E = 1; F / UNCL = 0). The grade points of the best six subjects are added up to a score.

HKCEE of the respondents are used as the dependent variable (CE) of the regression model in this study.

4.3 – Identifications of Independent Variables

In this chapter, all independent variables included in the model will be examined. Explanations for employing each independent variable will be given with reference to previous studies and the unique characteristics of built environment in Hong Kong. In addition, the way of utilizing the variables will be described.

4.3.1 – Type of Housing

According to the study of Ellaway and Macintyre (1998), the existence of negative effects of housing tenure and the type of housing on the children's well-being is confirmed. Many researchers (Boyle, 2002, Green and While, 1997, Evans et al., 2000, Haurin et al., 2002, Cairney, 2005) explain why the type of housing affects child development. Thus this aspect is worth further studies and should be included in the regression model in this study.

For the situation in Hong Kong, the type of housing can generally be divided into four main categories. They are Public Permanent Housing[4], Private Permanent Housing[5], Public Temporary Housing[6] and Private Temporary Housing[7]. The distribution of the population by type of housing in 2005 given by the Hong Kong Housing Authority is listed as follows:

Type of Housing	*% in the entire population*
Public Permanent Housing	49.5
- Rental Flats	31.2
- Subsidized Sale Flats	18.4
Private Permanent Housing	49.4
Public Temporary Housing	0
Private Temporary Housing	1.0

Figure 4.1 – Distribution of Population by Type of Housing in 2005

Source: Hong Kong Housing Authority (2006 website)

[4] Public Permanent Housing includes (i) Public Rental Housing (PRH) flats and interim housing provided by Housing Authority, and (ii) Public Rental Housing flats and Senior Citizen Residences Scheme (SEN) flats provided by Housing Society. , (iii) Housing Authority subsidized sale flats sold under the Tenants Purchase Scheme (TPS), (iv) Housing Authority subsidized sale flats under the Home Ownership Scheme (HOS), Private Sector Participation Scheme (PSPS), Middle Income Housing Scheme (MIHS), Buy or Rent Option Scheme (BRO) and Mortgage Subsidy Scheme (MSS), (v) Housing Society subsidized sale flats under the Flat-For-Sale Scheme (FFSS) and Sandwich Class Housing Scheme (SCHS).

[5] Private Permanent Housing includes (i) private flats built mainly for residential purposes, (ii) Housing Society Urban Improvement Scheme flats (UIS), (iii) rental flats of Hong Kong Settlers Housing Corporation Limited, (vii) staff quarters purposely built/provided by government, hospitals, private companies, etc., (viii) villas, bungalows/modern village houses, (ix) simple stone structures, and items (iii) – (v) in note 2 which can be traded in open market are classified as Private Permanent Housing after 1st Quarter 2002.

[6] Public Temporary Housing includes HA cottage areas and temporary housing areas. All HA cottage areas and temporary housing areas were cleared in December 2001 and in July 2001 respectively.

[7] Private Temporary Housing includes roof-top structures, contractor's matsheds, nissen huts, huts and places not intended for residential purposes.

For the ease of classification by the respondents, the type of housing will be classified into 8 categories to assist the investigation of the effect of type of housing on child development. In addition, the effect of proximity to public housing estate on child development will also be investigated in this study. In order to convey a clear idea of the independent variables to readers, a table of the independent variables concerning the type of housing is given as follows:

Independent Variables	*Description*	*Utilization of Variables*
PRI_OWN	Private Housing (self-owned)	Dummy variable which 1 represents the type of housing is of the specified type when the respondent was 10 – 14, 0 otherwise
PRI_RENT	Private Housing (rent)	
PUB_OWN	Public Housing (own)	
PUB_RENT	Public Housing (rent)	
HOS	Housing under Home Ownership Scheme	
JOB	Job-attached Housing	
OTHER	Other types of Housing	
NEARBY	The existence of public housing estate within 15-minute walking distance from the respondent's accommodation	Dummy variable which 1 represents there exists a public housing estate within 15-minute walking distance from the respondent's accommodation during the age of 10 – 14, 0 otherwise

Table 4.1 – Summary of Variables (Type of Housing)

4.3.2 – Physical Environment of the Accommodation

4.3.2.1 – Housing Density

As mentioned in Chapter 2, the negative impact of housing density on child development has been extensively studied and discussed. Particularly, Maxwell's study (2003) finds out that there is a negative effect of high density at home on the reading measure and word identification which are related to the academic performance done by 73 children (8 – 10 years old) in United States.

Following the rationale of the previous studies, the effect of several determinants of housing density on the dependent variable (CE) will be tested. According to the statistics given by the Hong Kong Housing Authority, the average living space (internal floor area) per person of the public rental housing provided by the Hong Kong Housing Authority is 11.7 square metres (equal to 125.9 square feet).

To facilitate the operation of the regression model, the housing density is quantified as the floor area per person (APP) which is the usable floor area in square feet (UFA) divided by the number of people living in the accommodation (NLIVE).

All of the three variables including APP, UFA and NLIVE will be incorporated to examine the individual effects of each of these variables on the dependent variable. Apart from this determinative variable of housing density, some additional variables will be added to facilitate the study of its influence on child development. The number of people sharing a bedroom (BED) and a room for studying (STUDY) which the respondent occupied will be included as independent variables. Furthermore, in view of the common phenomenon in Hong Kong that family members comprising of two or more generations (parents and grandparents) live together, the number of generations in the accommodation (GEN) will also be included as another independent variable in the model.

4.3.2.2 – Floor Level and External Views

As suggested by Richman (1977), children who live in high-rise apartments suffer negative effects related to restricted play opportunities and isolation in the residential unit. Thus an independent variable, the floor level on which the respondent lives (FLOOR), will be incorporated in the model. Specifically, two independent variables representing the availabilities of sea-view (SEA) and mountain-view (MOUNT) which is associated with the floor level of the accommodation will be added to the model in order to observe their effects on child development. A brief description of

the independent variables regarding the physical environment of the accommodation is listed as follows:

Independent Variables	*Description*	*Utilization of Variables*
UFA	Usable Floor Area	Quantity variable which represents the usable floor area in square feet
NLIVE	Number of People in the accommodation	Quantity variable which represents the number of people (including the respondent) in the accommodation
APP	Floor Area Occupied per person	Quantity variable which represents the floor area occupied per person (calculated by dividing UFA by NLIVE)
BED	Number of People sharing a Bedroom of which the respondent occupied	Quantity variable which represents the number of people sharing a bedroom (excluding the respondent), 1 represents the respondent owned a bedroom, 2 represents the respondents shared the bedroom with 1 person
STUDY	Number of People sharing a room for Studying of which the respondent occupied	Quantity variable which represents the number of people sharing a room for studying (excluding the respondent), 1 represents the respondent owned a room for studying, 2 represents the respondents shared the room with 1 person
GEN	Number of Generations in the accommodation	Quantity variable which represents the number of generations in the accommodation, 1 represents the respondent lived with 1 generation (e.g. parents or grandparents), 2 represents the respondents lived with 2 generations (e.g. both parents and grandparents)
FLOOR	Floor Level of the accommodation	Quantity variable which represents the floor level which the respondent lived on

SEA	The Availability of Sea-view from the accommodation	Dummy variable which 1 represents sea-view is available from the accommodation, 0 otherwise
MOUNT	The Availability of Mountain-view from the accommodation	Dummy variable which 1 represents mountain-view is available from the accommodation, 0 otherwise

Table 4.2 – Summary of Variables (Physical Environment of Accommodation)

4.3.3 – Built Environment of Neighborhood

The availability of the public utilities in the neighborhood has significant effect on child development since it determines the children's ability to take advantage of the abundant resources provided by the city (Berg and Medrich, 1980 and Woolley et al., 1999b). In addition, as suggested by Van Vliet (1983) and Gehl (1996) their accessibility of the public utilities is a critical factor to determine whether children can reach those utilities facilitating their all-rounded development by observing and participating in their community and others' communities.

The common public utilities which can be found in most districts in Hong Kong will be considered when deriving the independent variables for this model. They include public library, community centre, youth centre, amenity centre, sport

facility and MTR/KCR station. The provision of those utilities furnishes the children with the opportunities to observe, participate, learn and grow in the community. Concerning the accessibility, the proximity effect of the primary and secondary school will also be observed.

Particularly, amongst the public utilities, the provision of public open spaces captures most attention from researchers (Bettleheim, 1987, Vickerius and Sandberg, 2004, McKendrick et al., 2000, Maxwell, 1996 and Li, 2002) interested in urban planning and child development. Thus the effect of the provision of public open spaces on child development will also be studied by incorporating it into the model as an independent variable.

In the context of Hong Kong, according to the statistics provided by the Planning Department[8], the gross area of Open Space comprising the area used for parks, stadiums and playgrounds is approximately 21 square kilometers (1.9 % of the total area of land) in 2004. Whether the provision of the open spaces has an effect on child development will be examined in the model.

[8] The land usage figures as at end 2004 have been updated with satellite images dated December 2004, in-house survey information up to end 2004 and other relevant information from various Government departments.

In this model, the accessibility of the public utilities will be quantified as the traveling time (in minute) from the respondent's accommodation to the nearest particular kind of public utilities. Merely investigating the accessibility of the public utilities is insufficient to determine whether they are significant in affecting child development. Therefore the variables concerning respondent's usage of them will be incorporated in the model as well. They will be quantified as the number of times that the respondent visited there averagely per month. Then each data of the accessibility and the usage of the public utilities will be assigned with a rating (from 1 to 5) of ordinal scale in order to facilitate the analysis.

The detail and description of the independent variables concerning the built environment of neighborhood is summarized as follows:

Independent Variables	*Description*	*Utilization of Variables*
Traveling Time from Accommodation to the Nearest Public Utilities		
DLIB	Traveling Time from the accommodation to the nearest Library	In ordinal scale (1 – 5) of which 1 represents the least traveling time while 5 represents the greatest The basis of assigning the rating to the data in traveling time (in minute) is shown as follows:
DCOM	Traveling Time from the accommodation to the nearest Community Centre	
DYOU	Traveling Time from the accommodation to the nearest Youth Centre	
DAMEN	Traveling Time from the accommodation to the nearest Amenity Centre	

<table>
<tr><td>DMTR</td><td>Traveling Time from the accommodation to the nearest MTR/KCR Station</td><td rowspan="6"><table><tr><th>Traveling Time (in minute)</th><th>Rating</th></tr><tr><td>0 – 9</td><td>1</td></tr><tr><td>10 – 19</td><td>2</td></tr><tr><td>20 - 29</td><td>3</td></tr><tr><td>30 – 44</td><td>4</td></tr><tr><td>45 or above</td><td>5</td></tr></table></td></tr>
<tr><td>DSPORT</td><td>Traveling Time from the accommodation to the nearest Sport Facility</td></tr>
<tr><td>DOPEN</td><td>Traveling Time from the accommodation to the nearest Public Open Space</td></tr>
<tr><td>DPRI</td><td>Traveling Time from the accommodation to the Primary School that the respondent attended</td></tr>
<tr><td>DSEC</td><td>Traveling Time from the accommodation to the Secondary School that the respondent attended</td></tr>
<tr><td colspan="2">Usage of Public Utilities</td></tr>
<tr><td>ULIB</td><td>Usage of Library</td><td rowspan="6">In ordinal scale (1 – 5) of which 1 represents the least usage while 5 represents the greatest

The basis of assigning the rating to the data in number of times visiting per month (in average) is shown as follows:

<table><tr><th>Number of times visiting per month</th><th>Rating</th></tr><tr><td>0 – 1</td><td>1</td></tr><tr><td>2 – 3</td><td>2</td></tr><tr><td>4 – 5</td><td>3</td></tr><tr><td>6 – 9</td><td>4</td></tr><tr><td>10 or above</td><td>5</td></tr></table></td></tr>
<tr><td>UCOM</td><td>Usage of Community Centre</td></tr>
<tr><td>UYOU</td><td>Usage of Youth Centre</td></tr>
<tr><td>UAMEN</td><td>Usage of Amenity Centre</td></tr>
<tr><td>USPORT</td><td>Usage of Sport Facility</td></tr>
<tr><td>UOPEN</td><td>Usage of Public Open Space</td></tr>
</table>

Table 4.3 – Summary of Variables (Built environment of Neighborhood)

4.3.4 – Perception on Built Environment, Neighborhood and Community

According to Maxwell's study (2003), the children reported being disturbed when trying to read have serious consequences for academic performance as it is much difficult for them to concentrate and persist on their work. For the situation in Hong Kong, the phenomenon of being disturbed during reading at home is not rare due to the high housing density. Thus there exists an independent variable concerning their perception on this aspect (DISTURB) in the regression model to observe its effect on the child development.

On the neighborhood level, Exploring the environment which allows the children to take advantage of what the city offers is beneficial to child development as pointed out by some researchers (Huttenmoser, 1995, Lang and Deitz, 1990, Churchman, 2003). Lee and Rowe (1994) suggest that the degree of the autonomy given to children in expanding their environmental capabilities is greatly determined by some critical physical factors of the built environment. They believe the road system is one of the major determinants. In addition, Woolley et al. (1999a) point out the perception regarding the level of safety within the neighborhood environment as well as the means used to ensure it is another major essential determinant. In view of

these suggestions, two independent variables about their perception on the safety (SAFE) and the traffic condition (TRAF) within the neighborhood are added to the model.

Communities and neighborhoods are closest to where the children live and grow. The significance of participation and involvement in communities on the development of children is widely recognized by many researchers around the world (Maxwell, 1996, Li, 2004, Chawla, 2002). Thus the children's perception on the communities and their relationships with the communities in which they grow up is worth investigating. In this model, three variables derived from the children's perception on the communities in which they grow up are incorporated.

A summary of the independent variables concerning the children's perception on built environment, neighborhood and community is listed on next page to assist the readers to understand the meaning and utilization of them.

Independent Variables	*Description*	*Utilization of Variables*
Built Environment related		In ordinal scale (1 – 5): 1 – Strongly Disagree 2 – Disagree 3 – Neutral 4 – Agree 5 – Strongly Agree
DISTURB	The extent of agreement on the statement: 'I felt there was too much traffic outside my home.'	
Neighborhood related		
TRAF	The extent of agreement on the statement: 'I felt there was too much traffic outside my home.'	
SAFE	The extent of agreement on the statement: 'I felt it was not safe to move about to meet friends and find interesting things by myself.'	
Community related		
AWARE	The extent of agreement on the statement: 'I did have adequate awareness and knowledge in the history of the community I lived in.'	
PRIDE	The extent of agreement on the statement: 'I did take pride in the history of the community I lived.'	
BELONG	The extent of agreement on the statement: 'I felt the community belonged me and I belonged the community.'	

Table 4.4 – Summary of Variables (Perception on Built Environment, Neighborhood and Community)

4.4 – Model Specification

In this study, a regression model is formed to relate the dependent variable (CE) to a set of independent variables. Thus the effect and statistical significance of each independent variable on the dependent variable can be observed. Following the review of the previous studies and the discussion of the unique situation in Hong Kong, the attainment of child development which has been defined, in this study, as the result of Hong Kong Certificate of Education Examination (CE) is expected to be a general function of four types of variables:

Attainment of Child Development =

f(*Type of Housing*, *Physical Environment of Accommodation*, *Built Environment of Neighborhood*, *Perception on Built Environment, Neighborhood and Community*)

Incorporating the variables defined in chapter 4.2 and 4.3, the multiple regression model, which is assumed to be in linear form, is shown as a dynamic equation:

$$\mathbf{CE} = a + b_1\mathbf{PRI\_OWN} + b_2\mathbf{PRI\_RENT} + b_3\mathbf{PUB\_OWN} + b_4\mathbf{PUB\_RENT} + b_5\mathbf{HOS} + b_6\mathbf{JOB} + b_7\mathbf{TYPE*NEARBY} + c_1\mathbf{UFA} + c_2\mathbf{NLIVE} + c_3\mathbf{APP} + c_4\mathbf{FLOOR} + c_5\mathbf{SEA} + c_6\mathbf{MOUNT} + c_7\mathbf{BED} + c_8\mathbf{STUDY} + c_9\mathbf{GEN} + d_1\mathbf{DLIB} + d_2\mathbf{ULIB} + d_3\mathbf{DCOM} + d_4\mathbf{UCOM} + d_5\mathbf{DYOU} + d_6\mathbf{UYOU} + d_7\mathbf{DAMEN} + d_8\mathbf{UAMEN} + d_9\mathbf{DSPORT} + d_{10}\mathbf{USPORT} + d_{11}\mathbf{DPARK} + d_{12}\mathbf{UPARK} + d_{13}\mathbf{DMTR} + d_{14}\mathbf{DPRI} + d_{15}\mathbf{DSEC} + e_1\mathbf{DISTURB} + e_2\mathbf{TRAF} + e_3\mathbf{SAFE} + e_4\mathbf{AWARE} + e_5\mathbf{PRIDE} + e_6\mathbf{BELONG} + f$$

Where

CE is the total grade points of best six subjects obtained in HKCEE

PRI_OWN is a dummy variable where 1 presents the accommodation is private housing (self-owned), 0 otherwise

PRI_RENT is a dummy variable where 1 presents the accommodation is private rental housing, 0 otherwise

PUB_OWN is a dummy variable where 1 presents the accommodation is Housing Authority subsidized sale flat, 0 otherwise

PUB_RENT is a dummy variable where 1 presents the accommodation is public housing estate (rental), 0 otherwise

HOS is a dummy variable where 1 presents the accommodation is housing under Home Ownership Scheme, 0 otherwise

JOB is a dummy variable where 1 presents the accommodation is job-attached housing, 0 otherwise

TYPE is a dummy variable where 1 presents the accommodation is not public housing estate (rental) nor Housing Authority subsidized sale flat, 0 otherwise

NEARBY is a dummy variable where 1 presents there existed public housing estate(s) within 15-minute walking distance from the accommodation

UFA is the usable floor area (in square feet)

NLIVE is the number of people living in the accommodation

APP is the floor area occupied per person (in square feet)

FLOOR is the floor level on which the respondent lived

SEA is a dummy variable where 1 presents there existed sea-view from the accommodation, 0 otherwise

MOUNT is a dummy variable where 1 presents there existed mountain-view from the accommodation, 0 otherwise

BED is the number of people sharing a bedroom (including the respondent)

STUDY is the number of people sharing a room for studying (including the respondent)

GEN is the number of generations living with the respondent

DLIB is the traveling time from accommodation to the nearest library in ordinal scale

ULIB is the usage of library in ordinal scale

DCOM is the traveling time from accommodation to the nearest community centre in ordinal scale

UCOM is the usage of community centre in ordinal scale

DYOU is the traveling time from accommodation to the nearest youth centre in ordinal scale

UYOU is the usage of youth centre in ordinal scale

DAMEN is the traveling time from accommodation to the nearest amenity centre in ordinal scale

UAMEN is the usage of amenity centre in ordinal scale

DSPORT is the traveling time from accommodation to the nearest sport facility in ordinal scale

USPORT is the usage of sport facility in ordinal scale

DPARK is the traveling time from accommodation to the nearest park/public open space in ordinal scale

UPARK is the usage of park/public open space in ordinal scale

DMTR is the traveling time from accommodation to the nearest MTR/KCR station in ordinal scale

DPRI is the traveling time from accommodation to the primary school being studied in ordinal scale

DSEC is the traveling time from accommodation to the secondary school being studied in ordinal scale

DISTURB is the degree of agreement on feeling of being disturbed during study in ordinal scale

SAFETY is the degree of agreement on feeling of not being safe in the neighborhood in ordinal scale

TRAF is the degree of agreement on feeling of too much traffic in the neighborhood in ordinal scale

AWARE is the degree of agreement on having adequate awareness of the history of the community in ordinal scale

PRIDE is the degree of agreement on Taking pride in the history of the community in ordinal scale

BELONG is the degree of agreement on having sense of belonging to the community in ordinal scale

a is the constant term

$b_1, \ldots, b_7, c_1, \ldots, c_9, d_1, \ldots, d_{15}$ *and* $e_1, \ldots, e_6$ are the partial coefficients of their respective variables

f is the stochastic error term

In this model, TYPE is multiplied by NEARBY to form an independent variable in which the effect of the proximity of public housing on the child development can be observed. A summary of all variables incorporated is given in Appendix II. The expected signs for each independent variable are summarized in a table on next page:

INDEPENDENT VARIABLES IN MODEL SPECIFICATION	*DENOTED AS*	*EXPECTED SIGNS OF COEFFICIENT*
Type of Housing		
Private Housing (owned)	PRI_OWN	+
Private Rental Housing	PRI_RENT	+
Housing Authority subsidized sale flat	PUB_OWN	-
Public Housing Estate (rental)	PUB_RENT	-
Housing under Home Ownership Scheme	HOS	+
Job-attached housing	JOB	+
The Existence of a Public Housing Estate within 15 – minute walking distance from the accommodation	TYPE*NEARBY	-
Physical Environment of Neighborhood		
Usable Floor Area	UFA	+
Number of People Living in the Accommodation	NLIVE	-
Floor Area Occupied per Person	APP	+
Floor Lived on	FLOOR	+
The Existence of Sea-View	SEA	+
The Existence of Mountain-View	MOUNT	+
Number of People Sharing a Bedroom	BED	-
Number of People Sharing a Room for Studying	STUDY	-
Number of Generations Living with	GEN	-
Traveling Time from Accommodation to Public Utilities		
Library	DLIB	-
Community Centre	DCOM	-
Youth Centre	DYOU	-
Amenities Centre	DAMEN	-
Sport Facility	DSPORT	-
Park / Open Space	DPARK	-
MTR / KCR Station	DMTR	-

Primary School being Studied	DPRI	-
Secondary School being Studied	DSEC	-
Usage of Public Utilities		
Library	ULIB	+
Community Centre	UCOM	+
Youth Centre	UYOU	+
Amenities Centre	UAMEN	+
Sport Facility	USPORT	+
Park / Open Space	UPARK	+
Perception on Built Environment		
Feeling of being Disturbed during Study	DISTURB	-
Perception on Neighborhood		
Feeling of Safety in Neighborhood	SAFE	-
Feeling of too much Traffic	TRAF	-
Perception on Community		
Awareness of the History of the Community	AWARE	+
Pride in the History of the Community	PRIDE	+
Sense of Belonging to the Community	BELONG	+

Table 4.5 – Summary of Expected Signs of Variables

CHAPTER 5 – EMPRICAL RESULTS & ANALYSIS

5.1 – Introduction

Empirical results of the regression model are discussed in this chapter. Chapter 5.2 will present the descriptive statistics of the data. The results regarding the relationship between each of the identified independent variables and the dependent variable generated by the statistical software will be described in Chapter 5.3. In addition, a number of diagnostic tests will be performed in this chapter. Following the presentation of the generated results, discussion and analysis of the results will be given in Chapter 5.4 in which the independent variables with high statistical significance will be discussed in great detail. A brief summary on the results will be given at last session of this chapter. Based on the results, Chapter 5.5 will present the implications and recommendations to relevant parties.

5.2 – Descriptive Statistics

Total 364 usable questionnaires were received from different channels as mentioned in the previous chapter. The demographic information included respondents' gender, year of born, total grade point of the best six subjects in HKCEE, resident location, type of housing and physical quantities of housing will be described one by one.

Regarding the gender of all respondents, the distribution was even with 50.8 % of male and 48.2 % of female. The majority of respondents were born in 1988 (26.6 %) and 1984 (24.2 %). The distribution of year of born is given as follows:

Year of Born	*Frequency*	*%*
1988	97	26.6
1987	43	11.8
1986	31	8.5
1985	38	10.4
1984	88	24.2
1983	41	11.3
1982	14	3.8
Before 1982	12	3.3
Total	364	100

Table 5.1 – Distribution of Year of Born of respondents

The mean of total grade points of respondents was 16.3 with standard deviation of 6.89. A summary of the distribution of total grade point of respondents is given:

Total Grade Point	*Frequency*	*%*
0 – 5	17	4.7
6 – 10	69	19.0
11 – 15	81	22.3
16 – 20	89	24.5
21 – 25	67	18.4
26 – 30	41	11.3
Total	364	100.0

Table 5.2 – Distribution of Total Grade Point (HKCEE) of respondents

Regarding the geographic location of respondents' accommodation, the majority resided in New Territories (52.5 %). The sample of the data set used in the model is comparable to the distribution of population of age 10 – 14 in Hong Kong. A brief comparison between the statistics given by Population Census 2001 and the

distribution of the data in this study is provided to show the data set is representative sample of the whole population:

Location	*Frequency*	*%*	*% by 2001 Census Population (Age 10 -14)*
New Territories	191	52.5	55.5
Kowloon	113	31.0	27.4
Hong Kong Island	60	16.5	17.1
Total	364	100.0	100.0

Table 5.3 – Distribution of Geographic Location of respondents

For the type of housing, most respondents resided either public rental housing (39.8 %) or private housing (self-owned) (39.6 %).

Type of Housing	*Frequency*	*%*
Public Rental Housing	145	29.8
Housing Authority subsidized sale flat	7	1.9
Private Housing (self-owned)	144	39.6
Private Rental Housing	20	5.5
Housing under HOS	38	10.4
Job-Attached Housing	8	2.2

Other	2	0.5
Total	364	100.0

Table 5.4 – Distribution of Type of Housing of respondents

Concerning the physical environment of accommodation, the demographic statistics of the physical quantities including usable floor area, number of people living in the accommodation, floor area occupied per person and floor level is listed below:

Physical Quantity	*Mean*	*Standard Deviation*
Usable Floor Area (sq. feet)	522.4	240.84
Number of People living in the accommodation	4.6	1.13
Floor Area occupied per person (sq. feet)	117.2	51.37
Floor Level	12.7	8.40

Table 5.5 – Statistics of Physical Quantity of Accommodation of respondents

5.3 – Empirical Results

The results of the model, generated by the statistical software, EViews, are summarized in Appendix V. This chapter intends to discuss the variables with satisfactory statistical significance[9] as well as those with surprising results with regard to previous studies. Among 37 independent variables, there are 10 statistically significant variables in the regression equation. They will be discussed in later session.

The adjusted R^2 is 0.516738 which represents about 51.7 % of the variation within dependent variable (CE) can be explained by that within independent variables. The F-statistic[10] is 11.49041[11] which rejects the null hypothesis that none of the independent variable helps to explain the variations of the dependent variable at 95% confidence level. No comparison of similar model is available since it is an exploratory study on this topic.

[9] The minimum acceptable level of significance, for this study, is 0.1 (90% confidence level).
[10] The critical value of F-statistic is determined from the Distribution of the F-Statistic and the desired confidence level (95% in this study) as well as the degrees of freedom. The degrees of freedom are determined by the number of independent variables, and the number of observations minus the number of independent variables minus one.
[11] For this study, the critical value for the degrees of freedom calculated with 364 observations and 37 independent variables is 1.46 at 95% confidence level.

5.3.1 – Diagnostic Tests for the Results

In order to address the problems inherited in the model and test the reliability of the results, a number of diagnostic tests are performed and their details are summarized as follows:

5.3.1.1 – Durbin-Watson Test

Durbin-Watson Test is a diagnostic test for checking the presence of serial correlation in the residuals of a regression equation. It is assumed that the observations have a natural order. In this test, the check for a sequential dependence in which each residual is correlated with those before and after it in the sequence is performed. The test focuses specifically on the differences between successive residuals in the model (Durbin and Watson, 1951).

To execute the test, critical values for Durbin-Watson Statistic are needed. The computations of critical values for the distribution depend not only on sample size, but also the number of independent variables. Savin and Watson (1977) note that the critical value is not exact, but is only good approximations. According to Durbin-Watson Statistic Table (Durbin and Watson, 1951) given in Appendix III, the critical values for a sample of more than 100 observations and more than 5 independent

variables are 1.57, known as d_L, and 1.78, known as d_U at 95% confidence level. If the Durbin-Watson Statistic is below d_L, the results can be concluded that positive serial correlation exists. If it is above d_U, the results can be concluded that no serial correlation is indicated. In this study, the Durbin-Watson Statistic generated by EViews is 1.827732 which is greater than d_U. Thus it is concluded that no serial correlation presents in this model.

5.3.1.2 – Test for Multicollinearity

Multicollinearity is the condition while existence of a high level of correlation between independent variables is found in a regression model (Archdeacon, 1994). In extreme case, if the correlation between two independent variables is 1 (either positive or negative), it means that each of the variables can be considered a linear function of the other. Computing partial coefficients will become impossible.

In this model, as some variables related to physical environment of accommodation are influenced greatly by housing density, close correlations among several variables may unavoidably exist. A correlation matrix of the independent variables incorporated in the regression equation, generated by EViews, is given in Appendix IV. It is noted that the correlation coefficient between APP and UFA is 0.841886 which is relatively

high. However, removing either or both of them in the equation will limit the comprehensiveness of the scope of this study. In addition, as this study is to find out the major determinants of the built environment which will possibly impact on childe development instead of perform a prediction model on child development by incorporating independent variables. Also, there is no theoretical guidance on the standard of high level of muulticollinearity. In view of pursuing the objectives of this study, the problem of correlation between few variables is only addressed but not solved.

5.4 – Discussions and Analysis of Independent Variables

Applying minimum acceptable statistical significance at 90% confidence level, the independent variables which are statistically significant are shown as follows:

Dependent Variable: CE Method: Least Squares Sample: 1 364 Included observations: 364				
Variable	*Coefficient*	*t-statistic*	*p-value*	*Statistical Significance*[12]
APP	0.056119	2.378573	0.0180	**
BED	-1.376185	-2.162170	0.0313	**
GEN	1.178775	1.902583	0.0580	*
ULIB	0.644674	2.348091	0.0195	**
UCOM	0.930139	2.645868	0.0085	***
UYOU	0.885591	2.358455	0.0189	**
UPARK	0.528745	2.213219	0.0276	**
DISTURB	-0.683903	-2.782880	0.0057	***
AWARE	0.726584	2.018908	0.0443	**
BELONG	0.859102	2.420770	0.0160	**

Table 5.6 – Statistical Results of Significant Independent Variables

UCOM and DISTURB are both significant at 99% confidence level. APP, BED, ULIB, UYOU, UPARK, AWARE and BELONG are significant at 95% confidence level, and GEN is significant at 90% confidence level. The statistical

[12] *, ** and *** indicate significance at 90%, 95% and 99% confidence levels respectively.

significances of them will be discussed and the interpretation of the statistical results will be given.

5.4.1 – Type of Housing

The impact of type of housing on child development is extensively discussed as mentioned in chapter 2. In contrast, the results of this study surprisingly do not provide sufficient evidence to prove its significant impact on child development since there exists no statistically significant variable concerning type of housing in the regression equation. Also, the existence of public housing estate in proximity is found to have no significant impact on child development in this study. This contrast may be attributed to the fact that the variations of the built environment, the neighborhoods and the communities among different types of housing in Hong Kong are not sufficiently great to exert impact on child development. Compared with other determinants of built environment such as the physical environment of accommodation, the characteristic effect of type of housing in Hong Kong is relatively indistinct.

Furthermore, the proximity of public housing estate(s) to other types of housing in Hong Kong is not rare case. Most districts in Hong Kong offer public

housing estates as well as other types of housing whatsoever are provided by public or private sector. This phenomenon is different from the geographical distribution of different types of housing in other countries which usually develop public housing in less superior location. For these countries, public housing is unlikely to be located near other types of housing.

To conclude, the contention of previous studies that type of housing is an influential determinant of child development is not applicable to Hong Kong. Thus the sub-hypothesis I that is 'The type of housing makes impact on child development', which has been set in previous chapter, should be rejected due to insufficient provable evidence in this study.

5.4.2 – Physical Environment of accommodation

Among nine independent variables concerning the physical environment of accommodation, three of them including APP, BED and GEN are statistically significant. The effects of APP and BED on child development are significant at 95% confidence level with partial coefficients of 0.056119 and -1.376185 respectively.

The positive sign of the coefficient of APP implies the increase in floor area occupied per person has positive impact on child development. The greater the floor area

occupied per person, the greater the level of attainment of child development. This result is consistent with the expectation and supports the findings of previous studies concerning the effect of housing density on child development (Rodin, 1976, Evans et al., 2001a, and Ellaway and Macintyre, 1998) and particularly on children's academic performance (Maxwell, 2003).

In addition, the partial coefficient of BED is negatively signed which means the increase in number of people sharing a bedroom has negative impact on child development. Less people sharing a bedroom with a child will result in higher level of attainment of child development. This result echoes with the contention of Maxwell's study (2003) that children own a room will be more likely to feel having their places and feel less crowded at home which may exert certain effects on child development. And among the three significant variables in this aspect, it has the highest absolute value of its partial coefficient (-1.376185). This implies BED results in relatively greater impact on child development for the children at age of 10 – 14.

Moreover, the effect of GEN is found to be significant at 90% confidence level with partial coefficient of 1.178775. The positive sign means that the increase in number of generations living with a child will lead to higher level of attainment of child development. The result is unexpected that it contradicts the general notion in

Hong Kong that the presence of more generations in the same accommodation leads to unintended disturbance to children. However, it can be explained that the children can take advantages of the versatility of combinations of generations which may offer the children different sorts of knowledge and experiences. Their cognitive and social development can be enriched. As living with a number of generations is a unique phenomenon for households in Hong Kong, no finding from previous studies in this aspect can be compared.

It should be noticed that usable floor area and number of people living in the accommodation are insignificant in explaining the variation of child development. Besides, the floor level, existence of sea-view and mountain-view do nothing in affecting child development. The evidence to support the argument given by Richman (1977) that children who live in high-rise apartments suffer negative effects is therefore absent in this study.

To recap, the major determinants of child development are floor area occupied per person, number of people sharing a bedroom and number of generation living with. The sub-hypothesis II, which is 'Physical environment of accommodation does affect child development', can be partially confirmed by the above results.

5.4.3 – Built Environment of Neighborhood

The results show the accessibility of public utilities, interpreted as the traveling time from accommodation to the nearest one in this study, has insignificant impact on child development. This can be explained by the unique situation in Hong Kong. Owing to the high population density and the fact that Hong Kong is a tiny piece of land, the distance between accommodation and various kinds of public utilities varies in little extent since they are all compacted in this piece of land. Compared with other countries, the residential area and the recreational area are usually not in great proximity thanks to their advantage in land resources. The observation of the effects of accessibility of the public utilities on child development is more likely to be observable than that in Hong Kong. Thus the sub-hypothesis III 'The accessibility of public utilities has influence on child development' can be rejected.

Regarding the usage of public utilities, the results are consistent with the previous studies to certain extent which suggest children will benefit from using public utilities and being involved in the community. Among those variables about the usage of public utilities, four out of six are statistically significant, although they are at various confidence levels. They include ULIB, UCOM, UYOU and UPARK.

UCOM is significant at 99% confidence level with coefficient of 0.930139. ULIB, UYOU and UPARK are significant at 95% confidence level with partial coefficients of 0.644674, 0.885591 and 0.528745 respectively. All of their partial coefficients are positively signed which means the increase in the usage of them has positive impact on child development in the context of Hong Kong.

The results cohere with previous literatures. The impact of usage of public utilities is further confirmed by this study. Particularly, the usage of community centre has the most significant influence on child development. An explanation for this result is that the community centres in Hong Kong, based on the results of this study, are most likely to facilitate child development. The sub-hypothesis IV 'the usage of public utilities has impact on child development' can thus be confirmed by the results.

5.4.4 – Perception on Built Environment, Neighborhood and Community

Among the six variables in relation to the perception on built environment, neighborhood and community, three of them are statistically significant. The sign of DISTURB is negative with partial coefficient of -0.683903 and it is significant at 99% confidence level. It can be interpreted that the increase in level of agreement on feeling of being disturbed while reading or studying at home has significant negative impact on child development. This supports the finding of Maxwell's study (2003) that feeling of being disturbed while studying at home can be an evidence of high housing density which negatively affects child development. However, the two variables, associated with feeling of safety and feeling of too much traffic in neighborhood, are statistically insignificant to explain their impact on child development. This result is in fact unexpected since the perception on neighborhood and their subsequent effects on child development are often stressed by previous literatures.

On the topic of the perception on community, AWARE and BELONG are significant at 95% confidence level with partial coefficients of 0.726584 and 0.859102 respectively. Their coefficients are positively signed which means the

increase in level of agreement on feeling of having adequate awareness and knowledge in the history of the community or feeling of sense of belonging positively influences child development. This study further reinstates the importance of role of community, where children learn and grow, to child development and its applicability in Hong Kong.

To conclude, the last sub-hypothesis 'children's perception on built environment, neighborhood and community makes impact on child development' can be confirmed with the results of this study.

5.4.5 – Summary of Results

As one of the objectives of this study is to investigate the impact of built environment on child development, thirty-seven independent variables are put into the regression model to test their significance and magnitude of effects against the dependent variable (CE). Firstly, all variables related to type of housing are insignificant to explain their impact. And sub-hypothesis I is thus rejected.

Secondly, among nine variables related to physical environment of accommodation, three of them (APP, BED and GEN) have significant impact on child

development. The greater the floor area occupied per person, the less the number of people sharing a bedroom with the child. Also, the increase in number of generations living with the child will result in greater level of attainment of child development. Sub-hypothesis II is therefore confirmed.

Thirdly, with regard to the built environment of neighborhood, all of the nine variables concerning accessibility of public utilities are insignificant in this study which rejects the sub-hypothesis III. Among the six variables related to usage of public utilities, four (ULIB, UCOM, UYOU and UPARK) of them are significant which have positive impact on child development. And it gives sufficient evidence to confirm sub-hypothesis IV.

Fourthly, six variables about the children's perception on built environment, neighborhood and community are incorporated into the regression model. The results show that three variables (DISTURB, AWARE and BELONG) are significant. And sub-hypothesis V is confirmed.

5.5 – Implications of the Results and Recommendations

Solely discussing the statistical results of the regression model is meaningless and does not endow any value on this dissertation. Therefore the implications of findings in this study are discussed together with recommendations to relevant parties in this chapter.

From the results, this study has identified several major determinants of the impact of built environment on child development for children of age 10 – 14 in Hong Kong. Among those determinants concerning physical environment of accommodation, housing density and its related matters are confirmed to be significant in child development process. On the community level, children's usage, instead of accessibility, of public utilities is another major determinant of child development. Their involvements in community where they grow and learn enrich their development path in positive ways. The subsidiary effect of earnest participations in community during early adolescent (age of 10 – 14) embraces the built-up of sense of belonging to the community which leads to better child development. The question coming after is: How can we provide what our children need? This question will simultaneously trigger another debate on the responsibility of this duty.

In this century, the concept of sustainability of built environment is always pinpointed and discussed. Indubitably, this concept is certainly not a new proposal for the 'builders' and 'planners' of our built environment. However, to their interpretation, it is likely to be confined to the life-cycle of the physical creatures. Its implications to the processes of human development are in fact the most imperative but often neglected topic. In particular, every miniature change in built environment, neighborhood and community will result in significant changes in the modeling process of children's physical, psychological, cognitive, social and cultural characteristics in either positive or negative way. Children are indeed the most sensitive and responsive members in the community and they are valuable members of the community, both now and in the future. Although various parties recognize and encourage children's participation in urban planning process, children obviously do not have the 'practical' opportunity to participate and get involved in environmental planning and decision-making. Apart from extensive amount of past literatures around the world, this study has further confirmed the existence of impact of built environment, neighborhood and community on child development process within the context of Hong Kong. It is high time HKSAR government should listen to the children's genuine voices and take them into consideration while formulating the urban planning policies.

Growing Up in Cities organized by United Nations Educational, Scientific and Cultural Organization (UNESCO), an international project that seeks to understand the urban built environment from children's perspectives, can be brought to Hong Kong and the HKSAR government should get started on it. It has been successfully carried out globally in various locations including cities in Australia, Poland, Argentina, South Africa, India, United Kingdom, USA and Norway in order to create and maintain a desirable living and growing place for children. In this aspect, Hong Kong is obviously lagged behind in the globe.

The principle of this project is to investigate and document how children use the built environment and how they evaluate local resources and restrictions (Driskell, 2002). Applying the well-established framework of this project within the context of Hong Kong, the HKSAR government is recommended to employ a team of energetic and enthusiastic project coordinating members which comprises of built environment professionals (such as surveyors, planners and architects), social sciences researchers (such as developmental psychologists and educational psychologists) and local community members (such as representatives of children and from youth-serving agencies). In addition, members of the team must not be government officials or town planning decision makers to avoid preconception of the effectiveness of urban planning policies.

To start with, real-life observations can be performed to document the use of local area and build rapport with the young people in the community. Second, focused-group and small-group interviews with samples of girls and boys between the ages of 10 through 15 can be conducted to collect their opinions and perspectives directly from children. Drawings of the built environment and community where they live, produced by children, can be incorporated to provide additional insights for the team. Furthermore, the team can interview with children's parents and urban planning officials to understand their perceptions of children's environmental needs. Apart from the above mentioned activities, other countries participating in the project have carried out several innovative campaigns which can be also adopted in Hong Kong. Tours guided by children in assistance with the team are another useful method to obtain first-hand information for understanding their perspectives on environment. Photographs taken by children will also be a valuable tool to gather children's voices in a fun and creative way which can encourage them to participate. The information should be recorded and stored systematically to establish a comprehensive database.

Applying these insights and communicating with other project teams in other countries, the project facilitates relevant parties to understand and appreciate how the built environment affects children's lives and development. And it helps the

government to create a responsive indicator of built environments in order to formulate child-sensitive urban planning policies. The public awareness about the importance of working with children in formulating policies can be enhanced. In addition, it can operate as an efficiency model for observing the effectiveness of implementation of urban planning policies by government and as a function for assessing the worth of government's investments in children.

Apart from the suggested children participation proposal adopted from United Nations, various parties in the community can take the initiatives in creating a better city for children. When we start the discussion with the general physical environment of housing in Hong Kong, the fact that Hong Kong has been famously regarded as one of the most densely populated cities in the world is frequently emphasized. High-rise and high-density development is unavoidable in order to meet the pace of fast growing population and economy.

From economic point of view, this kind of intensive development is a direct and common routine to fully utilize the exceptionally scarce resources (land) and obtain higher value and economic return. No property developer is willing to sacrifice even a small portion of economic return for providing 'better', from the occupiers' perspective, built environment. More importantly, their unrewarded conscience will

be expected to earn nothing for themselves and no party will generously compensate their economic loss.

As pointed out in the results of this study, proper use of land can potentially facilitate the development of children. In view of the high housing density on a piece of land, it seems there are no other possible ways to accommodate the growing population. From the perspective of developers, persuading them to reduce the density of their developments is nearly impossible and not reasonable as they need to run their business. Alternatively, more attention should be focused on improving the neighborhood and the community. Children's participation in community has prominent effects on their development process as reinstated by the results of this study. Encouragement for developers to incorporate a concept of 'creating a community' into their residential developments during design stage should be offered. This can provide children with the opportunities and experiences to explore learn and grow in the community.

Besides, engagement in social interactions among various types of members in the community can serve as a supportive drive for children's development process. It will definitely help them to develop place identity and sense of belonging to the

community which they live. Citizenship which is the relationship between individuals and the community which they live can therefore be created in childhood.

One of the direct methods to create a better social environment which can be adopted by developers is to provide sufficient and safe open spaces in their developments for children and their families. This proposal will facilitate high flexibility of activities and wide diversity of social interactions which are proved to be beneficial to children in this study. Incidentally, the negative impact of high housing density can be compensated and minimized by the introduction of an advantageous community. The government is suggested to relax some development controls for rewarding the implementation of open spaces creating a concept of community. It can encourage developers to adopt the idea as well as secure their business. For instance, exclusion of floor areas for such usage accompanied by the execution plan of creating concept of community from GFA calculations of the development can be a motivating planning policy left to the government to consider.

On September 2000, Buildings Department has issued ‘Practice Note for Authorized Persons and Registered Structural Engineers, No.229’ to specify the exclusion of floor areas for recreational use. Children play area is categorized as active facility which is commonly accepted. However, in view of the escalating

population and intensifying housing density, the effectiveness of such provision in improving social environment for children should be enhanced. Further improvement of the planning policy in encouraging developers to incorporate a concept of community into their design should be needed. From the perspective of users, the participation of developers will create additional intangible value for both their developments and the companies when they can focus their publicity of their developments on that child-related concept.

In short, children are actually the largest consumers of built environment. Children should be able to grow, learn and explore in an environment as free of risk and dangers as possible. In addition, variation of experience, complexity, manipulability which the environment and community offers should be articulated in the urban design. The government should take the initiatives in encouraging developers to participate in the journey of creating a better city for our children. Furthermore, children participation in urban planning should be encouraged.

Recently, a cross-national project[13] called Sights and Sounds of My City, as a pioneer of advocating children's participation in Hong Kong, has been introduced. As introduced by Li (2004), the author, in cooperation with a local secondary school,

[13] Sights and Sounds of My City is launched globally in 2004. Apart from Hong Kong, Vietnam, India and Australia have carried out this project.

participates in the project organized by United Nations Educational, Scientific and Cultural Organization (UNESCO). Children's perspectives on different cities can be shared around the world in form of texts, sounds and videos which are solely designed by the children with the technical support by the secondary school. It provides children with a convenient and innovative channel for expressing and conveying their views on the urban environment to the planners. The government should provide sufficient support and encouragement to this sort of projects to enhance the awareness and popularity of importance of children's need and their participation on urban planning.

CHAPTER 6 – CONCLUSION

The influential impact of the built environment on child development has been extensively discussed by previous literatures around the world. Hong Kong known as a cosmopolitan city, the dedication to studying on this area is obviously lagged behind.

In virtue of this, this study intends to investigate the impact of built environment on child development within the context of Hong Kong. This study starts with a review of relevant literatures on built environment and child development. Hypotheses and five sub-hypotheses are set and a multiple linear regression model is employed to examine the relationships between the child development and a set of selected and defined determinants of built environment to test the sub-hypotheses. The data used for the model is collected from questionnaires. The results of this model reveal built environment, neighborhood and community do contribute in the process of child development within the context of Hong Kong. In addition, it

confirms three out of five sub-hypotheses of this study. At last, implications and recommendations are given based on the results.

6.1 – Summary of Findings and Implications

Thirty-seven independent variables associated with built environment are incorporated into a multiple linear regression model to test their significance and magnitude of effects against the dependent variable (CE) which is defined as the attainment of child development.

The results show that all variables related to type of housing are insignificant to explain their impact on child development. Among the nine variables related to physical environment of accommodation, three variables (APP, BED and GEN) are significant. For those related to the built environment of neighborhood, all of the nine variables concerning accessibility of public utilities are insignificant. Among the six variables related to usage of public utilities, four (ULIB, UCOM, UYOU and UPARK) of them are significant. Finally, among the six variables about the children's perception on built environment, neighborhood and community, three variables (DISTURB, AWARE and BELONG) are significant.

The findings of this study bring out five implications. First, the results imply that the children are unlikely to be affected by the type of housing in Hong Kong. Second, physical environment of accommodation does influence child development. Housing density and its related matters such as whether the child owns a bedroom deserve most attention and concern. Third, the insignificance of variables about accessibility of public utilities implies that the accessibility of public utilities and child development are not closely related. Fourth, children's usage of public utilities has significant positive impact on child development. At last, children's perception on built environment, neighborhood and community does contribute on child development process.

It is hoped that the implications and the recommendations proposed in previous chapter can enhance readers' awareness of the interrelationship between child development and our built environment. Despite a number of limitations, this study, as an exploratory research on this topic within context of Hong Kong, aims at giving readers certain extent of inspirations.

6.2 – Limitations of the Study

(i) Choice of Dependent Variable

The results of Hong Kong Certificate of Education Examination is defined as an objective benchmark of attainment of child development and used as the source of data for the sole dependent variable in this study. This measure is a relatively objective and reliable one among those which can be afforded by an undergraduate in view of time and resources. It, however, may not be the most appropriate choice for a research related to child development. Both behavioral and emotional measures which are important benchmark of child development should also be incorporated in the model as dependent variables. However, it does demand much more resource such as time as well as professional knowledge and support of child psychology.

(ii) Selection of Data set

The data used in this study is collected randomly from various channels based on two criteria set in Chapter 2. It may not be the most appropriate one. Instead, a selected data set should be used to avoid unwanted effects on the dependent variables. For instance, a sample of students in secondary schools of the same band can be selected to eliminate the effects due to the variations on the quality of education and the school environment. However, time constraints should be considered.

6.3 – Suggestion for Further Research

In this study, by incorporating the data collected from questionnaires, a built environment model for child development is established to investigate the impact of the built environment, neighborhood and community on child development in Hong Kong. Further studies on this topic can be carried out to have a larger coverage on the scope of this topic of study.

Large number of literatures stresses the benefits for children participating in urban planning process. In view of this, researches on children participation in urban planning process and its impact on their development process can be done to test the interrelationship between them in Hong Kong. Therefore the value of involving children during the decision-making process of formulating urban policies can be appreciated. These will provide some insights for the government officials.

Moreover, the impact of built environment on child development is not only confined to the scope defined in this study. Some social-economical determinants such as home ownership can be investigated in further studies to have a much comprehensive picture on this issue. In addition, the impact of built environment on

children's view and their attitudes to participate in the community can also be a possible research topic to make contributions to our children and built environment.

Appendix I

Sample of Questionnaire

HOME ENVIRONMENT SURVEY

PART I

*** Please answer this part with reference to your age from TEN to FORTHTEEN. ***
If you did move during the above period, please answer the questions with regard to the most occupied unit.
*** 請以十歲至十四歲時的居住情況作答。***
*** 若你曾於十歲至十四歲時搬家，答案則以你在這段期間居住時間最長的居所爲準。***

1 Which district did you live in Hong Kong? 你當時住在哪一區？ 1. _____

2 What type of accommodation did you occupy? * 你當時住在哪一類房屋？*
a) Private housing (self-owned) 自置私人房屋 **b)** Public housing estate (rental) 公共屋邨(租住)
c) Housing Authority subsidized sale flat 房屋委員會資助出售單位 **d)** Housing under HOS 居者有其屋
e) Private rental housing 私人租住房屋 **f)** Temporary housing 臨時房屋 **g)** Job-attached accommodation 職員宿舍
h) Accommodation offered by charities/schools 公共機構或學校安排的居所
i) other:_____(please specify) 其他: _____(請註明)

3 Was there a public housing estate near your home within 15-minute walking distance?
你當時的居所附近的15分鐘步行範圍內有沒有公共屋邨？ 3. Yes / No
*If you lived in public housing estate during the period, you do NOT need to answer this question.
*若你當時住在公共屋邨，你便不需要回答此問題。

4 What was the usable floor area of the accommodation?
你當時的居所的實用面積是多少？ 4. _____
*Please provide the area in square feet, otherwise please specify the unit.
*請以平方呎作單位，否則請註明所用之單位。

5 How many people (including yourself) did you live with?
你當時與多少人同住(包括你自己)？ 5. _____

6 Which floor did you live on? 你當時住在哪一層？ 6. _____

7 Did your room/flat have sea view? 你當時的房間/居所有沒有海景？ 7. Yes / No

8 Did your room/flat have mountain view? 你當時的房間/居所有沒有山景？ 8. Yes / No

9 How many people (including yourself) did you share a bedroom with?
你當時與多少人共用同一睡房(包括你自己)？ 9. _____
*If you owned a bedroom, please fill 1. 若你擁有自己的睡房，請填1。

10 How many people (including yourself) did you share a room for studying at home with?
你當時與多少人共用同一房間作學習之用(包括你自己)？ 10. _____
*If you owned a room for studying/reading, please fill 1.
*若你自己擁有一房間作學習之用，請填1。

11 How many generations did you live with? 你當時與多少代同住？ 11. _____
*If you lived with parents and also grandparents during the period, please fill 2.
*若你當時與父母及祖父母同住，請填2。

PART II

*** Please answer this part with reference to your age from TEN to FORTHTEEN. ***
If you did move during the above period, please answer the questions with regard to the most occupied unit.
*** 請以十歲至十四歲時的居住情況作答。***
*** 若你曾於十歲至十四歲時搬家，答案則以你在這段期間居住時間最長的居所爲準。***

1 a) Traveling time (in minutes) from your home to the nearest library? 1 a) _____
你用多少時間(以分鐘作單位)由家前往最近的圖書館？
b) How many times did you go there per month? (on the average) * 你平均每月到這裡多少次？
never less than 1 1 2 3 4 5 6 7 8 9 10 more than 10

2 a) Traveling time (in minutes) from your home to the nearest community centre? 2 a) _____
你用多少時間(以分鐘作單位)由家前往最近的社區中心？
b) How many times did you go there per month? (on the average) * 你平均每月到這裡多少次？
never less than 1 1 2 3 4 5 6 7 8 9 10 more than 10

3 a) Traveling time (in minutes) from your home to the nearest youth centre?
你用多少時間(以分鐘作單位)由家前往最近的青少年中心? 3 a) _____

b) How many times did you go there per month? (on the average) * 你平均每月到這裡多少次?
never less than 1 1 2 3 4 5 6 7 8 9 10 more than 10

4 Traveling time (in minutes) from your home to the nearest MTR / KCR station?
你用多少時間(以分鐘作單位)由家前往最近的地鐵站或火車站? 4 _____

5 a) Traveling time (in minutes) from your home to the nearest sport facility?
你用多少時間(以分鐘作單位)由家前往最近的運動設施?
*Including simply a single basketball court or swimming pool. 包括一個籃球場或游泳池。 5 a) _____

b) How many times did you go there per month? (on the average) * 你平均每月到這裡多少次?
never less than 1 1 2 3 4 5 6 7 8 9 10 more than 10

6 a) Traveling time (in minutes) from your home to the nearest amenities centre?
你用多少時間(以分鐘作單位)由家前往最近的文娛康樂中心? 6 a) _____

b) How many times did you go there per month? (on the average) * 你平均每月到這裡多少次?
never less than 1 1 2 3 4 5 6 7 8 9 10 more than 10

7 a) Traveling time (in minutes) from your home to the nearest park / open green space?
你用多少時間(以分鐘作單位)由家前往最近的公園或公共綠化場所? 7 a) _____

b) How many times did you go there per month? (on the average) * 你平均每月到這裡多少次?
never less than 1 1 2 3 4 5 6 7 8 9 10 more than 10

8 Traveling time (in minutes) from your home to your i) primary school ii) secondary school at that time? 你用多少時間(以分鐘作單位)由家前往你當時的i) 小學 i) 中學? 8 i) _____
ii) _____

***Please circle the most appropriate choice. 請圈出最適合的答案。**

PART III

*** Please answer this part with reference to your age from TEN to FORTHTEEN. ***
If you did move during the above period, please answer the questions with regard to the most occupied unit.
*** 請以十歲至十四歲時的居住情況作答。***
*** 若你曾於十歲至十四歲時搬家,答案則以你在這段期間居住時間最長的居所爲準。***

***Please circle the most appropriate choice. 請圈出最適合的答案。**
(1 - Strongly DISAGREE 非常不同意, 5 - Strongly AGREE 非常同意)

1 I felt there was too much traffic outside my home. 我當時感到我的居住環境附近的交通太繁忙。
1 2 3 4 5

2 I felt it was not safe to move about to meet friends and find interesting things by myself. 我當時感到我的居住環境未能令我安全地獨自出外結識朋友及尋找有趣的事物。
1 2 3 4 5

3 I felt disturbed when I was studying or reading at home. 我當時在家中閱讀或學習時,感到被滋擾。
1 2 3 4 5

4 I did have adequate awareness and knowledge in the history of the community I lived in.
我當時對自己所居住的社區的歷史有足夠的認識及察覺。
1 2 3 4 5

5 I did take pride in the history of the community I lived. 我當時以我所居住的社區的歷史爲榮。
1 2 3 4 5

6 I felt the community belonged me and I belonged the community.
我當時感到我所居住的社區是屬於我的,而我是屬於我所居住的社區。
1 2 3 4 5

PART IV

1 What is your gender? 請問你的性別是? 1. Male / Female

2 Which year were you born? 你於哪年出生? 2. _____

3 Which year did you attend HKCEE? 你於哪年參加香港中學會考? 3. _____

4 What were your total grade points (best six subjects) obtained in HKCEE?
你的香港中學會考成績最佳六科的總積點是多少? 4. _____
*Grade point reference 積點計算方法: A=5, B=4, C=3, D=2, E=1
*If you attended HKCEE more than once, please fill in the result of your first attempt.
*若你曾參加多於一次香港中學會考,請以第一次的會考成績爲準。

- Thank you for your participation -

Appendix II

Summary of Variables

VARIABLES IN MODEL SPECIFICATION	*TYPE OF VARIABLES**	*DENOTED AS*	*PREVIOUS STUDIES*
Dependent Variable			
HKCEE Result	I	CE	Based on situation in Hong Kong
Independent Variables			
Type of Housing			
Private Housing (owned)	II	PRI_OWN	Wilner et al. (1962) Evans et al. (2001b) Ellaway & Macintyre (1998) Haurin et al. (2002) Cairney (2005)
Private Rental Housing	II	PRI_RENT	
Housing Authority subsidized sale flat	II	PUB_OWN	
Public Housing Estate (rental)	II	PUB_RENT	
Housing under Home Ownership Scheme	II	HOS	
Job-attached housing	II	JOB	
Other (e.g. Small House)	II	OTHER	
The Existence of a Public Housing Estate within 15 – minute walking distance from the accommodation	II	NEARBY	
Physical Environment of Accommodation			
Usable Floor Area	I	UFA	Maxwell (2003) Rodin (1976) Evans et al. (2001a) Ellaway & Macintyre (1998)
Number of People Living in the Accommodation	I	NLIVE	
Floor Area Occupied per Person	I	APP	
Floor Lived on	I	FLOOR	Richman (1977)
The Existence of Sea-View	II	SEA	Based on the situation in Hong Kong
The Existence of Mountain-View	II	MOUNT	
Number of People Sharing a Bedroom	I	BED	Maxwell (2003) Rodin (1976) Evans et al. (2001a) Ellaway & Macintyre (1998)
Number of People Sharing a Room for Studying	I	STUDY	
Number of Generations Living with	I	GEN	Based on the situation in Hong Kong
Built Environment of Neighborhood			
Traveling Time from Accommodation to the Nearest Public Utilities			
Library	III	DLIB	Woolley et al. (1999b) Maxwell (1996)
Community Centre	III	DCOM	
Youth Centre	III	DYOU	
Amenities Centre	III	DAMEN	
Sport Facility	III	DSPORT	Vickerius & Sandberg (2004) McKendrick et al. (2000)
Park / Open Space	III	DPARK	
MTR / KCR Station	III	DMTR	Woolley et al. (1999b) Maxwell (1996)
Primary School being Studied	III	DPRI	
Secondary School being Studied	III	DSEC	
Usage of Public Utilities			
Library	III	ULIB	Woolley et al. (1999b) Maxwell (1996)
Community Centre	III	UCOM	
Youth Centre	III	UYOU	
Amenities Centre	III	UAMEN	

Sport Facility	III	USPORT	Vickerius & Sandberg (2004) McKendrick et al. (2000)
Park / Open Space	III	UPARK	
Perception on Built Environment, Neighborhood and Community			
Built Environment related			
Feeling of being Disturbed during Study	III	DISTURB	Maxwell (2003)
Neighborhood related			
Feeling of Safety in Neighborhood	III	SAFE	Maxwell (1996)
Feeling of too much Traffic	III	TRAF	
Community related			
Awareness of the History of the Community	III	AWARE	Chawla (2002)
Pride in the History of the Community	III	PRIDE	
Sense of Belonging to the Community	III	BELONG	

Note :

Type I - Quantitative continuous variables

Type II - Dummy variables

Type III - Ordinal scale

Appendix III

Durbin-Watson Statistic Table

Significance Points of d_l and d_u at 5%										
	k = 1		k = 2		k = 3		k = 4		k = 5+	
n	d_l	d_u	d_l	d_u	d_l	d_u	d_l	d_u	d_l	d_u
50	1.50	1.59	1.46	1.63	1.42	1.67	1.38	1.72	1.34	1.77
60	1.55	1.62	1.51	1.65	1.48	1.69	1.44	1.73	1.41	1.77
70	1.58	1.64	1.55	1.67	1.52	1.7	1.49	1.74	1.46	1.77
80	1.61	1.66	1.59	1.69	1.56	1.72	1.53	1.74	1.51	1.77
90	1.63	1.68	1.61	1.70	1.59	1.73	1.57	1.75	1.54	1.78
100 +	1.65	1.69	1.63	1.72	1.61	1.74	1.59	1.76	1.57	1.78

Note: k represents number of independent variables where n represents number of observations

APPENDIX IV

Correlation Matrix of the Independent Variables

	PUB_ RENT	PRI_ OWN	PRI_ RENT	PUB_ OWN	HOS	OTHER	JOB	TYPE* NEARBY	UFA	NLIVE	APP	FLOOR	SEA	MOUNT	BED	STUDY	GEN
PUB_ RENT	1.00	-0.66	-0.20	-0.11	-0.28	-0.06	-0.12	-0.63	-0.43	0.00	-0.44	0.08	-0.12	0.08	0.20	0.21	-0.02
PRI_ OWN	-0.66	1.00	-0.20	-0.11	-0.28	-0.06	-0.12	0.33	0.41	0.09	0.37	-0.12	0.13	-0.07	-0.13	-0.14	0.08
PRI_ RENT	-0.20	-0.20	1.00	-0.03	-0.08	-0.02	-0.04	0.16	-0.04	-0.13	0.03	-0.04	0.00	-0.17	-0.07	-0.06	-0.13
PUB_ OWN	-0.11	-0.11	-0.03	1.00	-0.05	-0.01	-0.02	-0.11	-0.04	0.05	-0.05	-0.02	-0.06	-0.02	0.08	0.07	0.06
HOS	-0.28	-0.28	-0.08	-0.05	1.00	-0.03	-0.05	0.33	-0.02	-0.09	0.03	0.15	0.03	0.09	-0.08	-0.11	-0.04
OTHER	-0.06	-0.06	-0.02	-0.01	-0.03	1.00	-0.01	0.10	0.05	0.03	0.04	-0.10	-0.03	0.00	0.01	0.02	0.02
JOB	-0.12	-0.12	-0.04	-0.02	-0.05	-0.01	1.00	0.12	0.16	0.02	0.15	-0.05	-0.01	0.07	-0.03	-0.01	0.00
TYPE* NEARBY	-0.63	0.33	0.16	-0.11	0.33	0.10	0.12	1.00	0.14	0.02	0.13	-0.08	0.05	-0.04	-0.03	-0.05	-0.02
UFA	-0.43	0.41	-0.04	-0.04	-0.02	0.05	0.16	0.14	1.00	0.28	0.84	-0.07	0.11	0.04	-0.15	-0.14	0.22
NLIVE	0.00	0.09	-0.13	0.05	-0.09	0.03	0.02	0.02	0.28	1.00	-0.24	-0.05	0.00	0.02	0.52	0.52	0.46
APP	-0.44	0.37	0.03	-0.05	0.03	0.04	0.15	0.13	0.84	-0.24	1.00	-0.03	0.12	0.02	-0.42	-0.41	-0.05
FLOOR	0.08	-0.12	-0.04	-0.02	0.15	-0.10	-0.05	-0.08	-0.07	-0.05	-0.03	1.00	0.26	0.18	-0.01	-0.04	-0.01
SEA	-0.12	0.13	0.00	-0.06	0.03	-0.03	-0.01	0.05	0.11	0.00	0.12	0.26	1.00	0.06	-0.05	-0.12	0.01
MOUNT	0.08	-0.07	-0.17	-0.02	0.09	0.00	0.07	-0.04	0.04	0.02	0.02	0.18	0.06	1.00	0.01	-0.02	0.00
BED	0.20	-0.13	-0.07	0.08	-0.08	0.01	-0.03	-0.03	-0.15	0.52	-0.42	-0.01	-0.05	0.01	1.00	0.76	0.17
STUDY	0.21	-0.14	-0.06	0.07	-0.11	0.02	-0.01	-0.05	-0.14	0.52	-0.41	-0.04	-0.12	-0.02	0.76	1.00	0.21
GEN	-0.02	0.08	-0.13	0.06	-0.04	0.02	0.00	-0.02	0.22	0.46	-0.05	-0.01	0.01	0.00	0.17	0.21	1.00
DLIB	-0.07	0.01	-0.06	-0.04	0.12	-0.01	0.05	-0.04	0.13	-0.01	0.13	0.10	0.02	0.15	-0.13	-0.11	0.07
ULIB	-0.10	0.18	-0.02	0.07	-0.10	-0.01	-0.10	0.00	0.10	-0.07	0.14	-0.05	-0.01	-0.15	-0.13	-0.17	0.01
DCOM	-0.31	0.20	0.12	0.00	0.06	-0.07	0.08	0.13	0.30	0.00	0.28	-0.11	0.04	0.03	-0.09	-0.15	-0.03
UCOM	-0.06	0.07	-0.01	-0.03	0.06	0.01	-0.08	0.04	0.20	-0.03	0.21	-0.04	0.05	0.01	-0.13	-0.14	0.09
DYOU	-0.25	0.20	0.06	-0.01	-0.01	-0.07	0.13	0.08	0.28	0.08	0.22	-0.17	-0.08	0.06	0.04	0.02	0.09
UYOU	-0.08	0.07	-0.04	-0.06	0.08	0.18	-0.07	0.00	0.18	-0.01	0.19	-0.02	-0.01	0.03	-0.17	-0.16	0.05
DMTR	0.01	-0.01	-0.05	0.04	0.03	-0.05	0.00	-0.07	0.07	-0.02	0.08	-0.01	0.07	0.19	-0.01	0.02	-0.03
DSPORT	-0.07	0.12	-0.04	-0.07	-0.02	-0.05	0.00	0.05	0.01	0.04	0.01	-0.01	0.06	0.06	-0.01	0.01	0.01
USPORT	-0.07	0.09	0.03	0.00	-0.02	0.08	-0.12	0.06	0.10	-0.02	0.10	0.01	0.04	-0.05	-0.09	-0.08	0.05
DAMEN	-0.03	0.07	-0.11	-0.04	0.05	-0.03	-0.03	0.00	0.05	0.08	0.01	0.04	-0.07	0.08	-0.04	0.01	0.10
UAMEN	-0.13	0.09	0.12	0.01	-0.04	0.05	0.01	0.03	0.14	-0.09	0.18	0.01	0.02	-0.02	-0.11	-0.05	-0.08
DPARK	-0.14	0.10	0.02	0.00	0.03	0.01	0.03	0.09	0.11	-0.04	0.14	-0.07	-0.05	-0.01	-0.11	-0.08	-0.03
UPARK	-0.10	0.06	-0.04	-0.06	0.07	0.12	0.05	0.08	0.21	0.04	0.18	0.01	0.03	-0.01	-0.09	-0.11	0.09
DPRI	-0.14	0.12	-0.03	0.03	0.02	0.07	0.04	0.07	0.14	-0.03	0.17	0.13	0.09	0.00	0.00	-0.08	0.04
DSEC	-0.15	0.06	-0.07	0.05	0.13	0.03	0.08	0.05	0.13	0.01	0.15	0.14	0.11	-0.05	0.00	-0.08	0.01
TRAF	-0.04	0.00	0.16	-0.06	-0.03	-0.03	-0.01	0.07	-0.15	-0.04	-0.15	-0.08	-0.10	-0.20	0.12	0.15	-0.06
SAFE	0.05	-0.07	0.10	-0.03	-0.05	0.09	0.02	-0.05	-0.12	-0.07	-0.10	0.01	-0.01	-0.07	0.05	0.10	-0.05
DISTURB	0.13	-0.14	0.07	0.04	-0.06	-0.01	0.02	-0.02	-0.19	0.20	-0.29	-0.05	-0.11	-0.04	0.26	0.31	0.02
AWARE	-0.17	0.12	0.05	0.04	0.03	0.03	-0.04	0.00	0.13	-0.11	0.18	0.06	0.13	-0.03	-0.23	-0.23	-0.06
PRIDE	-0.18	0.07	0.10	0.06	0.10	0.03	-0.10	0.06	0.13	-0.07	0.15	0.01	0.11	0.00	-0.19	-0.18	-0.01
BELONG	-0.20	0.07	0.10	0.05	0.11	0.05	-0.01	0.09	0.13	-0.05	0.15	0.04	0.14	-0.05	-0.22	-0.15	-0.04

	DLIB	ULIB	DCOM	UCOM	DYOU	UYOU	DMTR	DSPORT	USPORT	DAMEN	UAMEN	DPARK	UPARK	DPRI	DSEC
PUB_RENT	-0.07	-0.10	-0.31	-0.06	-0.25	-0.08	0.01	-0.07	-0.07	-0.03	-0.13	-0.14	-0.10	-0.14	-0.15
PRI_OWN	0.01	0.18	0.20	0.07	0.20	0.07	-0.01	0.12	0.09	0.07	0.09	0.10	0.06	0.12	0.06
PRI_RENT	-0.06	-0.02	0.12	-0.01	0.06	-0.04	-0.05	-0.04	0.03	-0.11	0.12	0.02	-0.04	-0.03	-0.07
PUB_OWN	-0.04	0.07	0.00	-0.03	-0.01	-0.06	0.04	-0.07	0.00	-0.04	0.01	0.00	-0.06	0.03	0.05
HOS	0.12	-0.10	0.06	0.06	-0.01	0.08	0.03	-0.02	-0.02	0.05	-0.04	0.03	0.07	0.02	0.13
OTHER	-0.01	-0.01	-0.07	0.01	-0.07	0.18	-0.05	-0.05	0.08	-0.03	0.05	0.01	0.12	0.07	0.03
JOB	0.05	-0.10	0.08	-0.08	0.13	-0.07	0.00	0.00	-0.12	-0.03	0.01	0.03	0.05	0.04	0.08
TYPE* NEARBY	-0.04	0.00	0.13	0.04	0.08	0.00	-0.07	0.05	0.06	0.00	0.03	0.09	0.08	0.07	0.05
UFA	0.13	0.10	0.30	0.20	0.28	0.18	0.07	0.01	0.10	0.05	0.14	0.11	0.21	0.14	0.13
NLIVE	-0.01	-0.07	0.00	-0.03	0.08	-0.01	-0.02	0.04	-0.02	0.08	-0.09	-0.04	0.04	-0.03	0.01
APP	0.13	0.14	0.28	0.21	0.22	0.19	0.08	0.01	0.10	0.01	0.18	0.14	0.18	0.17	0.15
FLOOR	0.10	-0.05	-0.11	-0.04	-0.17	-0.02	-0.01	-0.01	0.01	0.04	0.01	-0.07	0.01	0.13	0.14
SEA	0.02	-0.01	0.04	0.05	-0.08	-0.01	0.07	0.06	0.04	-0.07	0.02	-0.05	0.03	0.09	0.11
MOUNT	0.15	-0.15	0.03	0.01	0.06	0.03	0.19	0.06	-0.05	0.08	-0.02	-0.01	-0.01	0.00	-0.05
BED	-0.13	-0.13	-0.09	-0.13	0.04	-0.17	-0.01	-0.01	-0.09	-0.04	-0.11	-0.11	-0.09	0.00	0.00
STUDY	-0.11	-0.17	-0.15	-0.14	0.02	-0.16	0.02	0.01	-0.08	0.01	-0.05	-0.08	-0.11	-0.08	-0.08
GEN	0.07	0.01	-0.03	0.09	0.09	0.05	-0.03	0.01	0.05	0.10	-0.08	-0.03	0.09	0.04	0.01
DLIB	1.00	-0.04	0.27	0.07	0.24	0.02	0.20	0.17	0.06	0.17	-0.01	0.16	0.16	0.02	0.09
ULIB	-0.04	1.00	-0.08	0.30	-0.11	0.24	-0.06	-0.02	0.20	0.02	0.28	0.04	0.22	-0.03	-0.01
DCOM	0.27	-0.08	1.00	-0.03	0.61	0.01	0.01	0.12	0.00	0.17	-0.09	0.18	-0.01	0.16	0.10
UCOM	0.07	0.30	-0.03	1.00	-0.05	0.64	0.01	0.03	0.24	0.03	0.22	0.06	0.23	0.04	0.13
DYOU	0.24	-0.11	0.61	-0.05	1.00	-0.11	0.09	0.14	-0.05	0.22	-0.08	0.17	-0.01	0.11	0.12
UYOU	0.02	0.24	0.01	0.64	-0.11	1.00	-0.04	-0.05	0.20	0.00	0.18	0.10	0.20	0.05	0.04
DMTR	0.20	-0.06	0.01	0.01	0.09	-0.04	1.00	0.09	-0.01	0.10	0.10	0.03	0.03	-0.06	0.05
DSPORT	0.17	-0.02	0.12	0.03	0.14	-0.05	0.09	1.00	-0.08	0.21	-0.02	0.20	-0.02	0.05	0.11
USPORT	0.06	0.20	0.00	0.24	-0.05	0.20	-0.01	-0.08	1.00	-0.02	0.37	0.01	0.22	-0.04	0.00
DAMEN	0.17	0.02	0.17	0.03	0.22	0.00	0.10	0.21	-0.02	1.00	-0.22	0.18	-0.04	0.06	0.00
UAMEN	-0.01	0.28	-0.09	0.22	-0.08	0.18	0.10	-0.02	0.37	-0.22	1.00	-0.04	0.27	-0.06	0.12
DPARK	0.16	0.04	0.18	0.06	0.17	0.10	0.03	0.20	0.01	0.18	-0.04	1.00	-0.02	0.08	0.10
UPARK	0.16	0.22	-0.01	0.23	-0.01	0.20	0.03	-0.02	0.22	-0.04	0.27	-0.02	1.00	-0.09	-0.02
DPRI	0.02	-0.03	0.16	0.04	0.11	0.05	-0.06	0.05	-0.04	0.06	-0.06	0.08	-0.09	1.00	0.45
DSEC	0.09	-0.01	0.10	0.13	0.12	0.04	0.05	0.11	0.00	0.00	0.12	0.10	-0.02	0.45	1.00
TRAF	-0.07	0.01	-0.02	-0.14	0.03	-0.14	-0.09	-0.05	-0.07	0.00	-0.05	0.05	-0.09	0.01	-0.06
SAFE	-0.07	-0.08	0.00	-0.03	0.02	-0.10	-0.01	-0.04	0.03	0.05	0.06	0.04	-0.01	0.05	0.09
DISTURB	-0.18	-0.21	-0.15	-0.23	-0.05	-0.18	-0.07	-0.10	-0.14	0.04	-0.18	0.00	-0.17	-0.08	-0.08
AWARE	0.09	0.27	0.00	0.25	-0.08	0.30	0.07	-0.05	0.19	-0.07	0.20	-0.02	0.26	-0.02	0.03
PRIDE	0.07	0.26	-0.02	0.20	-0.08	0.28	0.06	0.02	0.20	-0.03	0.23	0.03	0.24	-0.05	0.05
BELONG	0.08	0.26	0.05	0.16	-0.04	0.19	0.04	-0.05	0.24	-0.02	0.19	-0.04	0.24	-0.09	-0.06

	TRAF	SAFE	DISTURB	AWARE	PRIDE	BELONG
PUB_RENT	-0.04	0.05	0.13	-0.17	-0.18	-0.20
PRI_OWN	0.00	-0.07	-0.14	0.12	0.07	0.07
PRI_RENT	0.16	0.10	0.07	0.05	0.10	0.10
PUB_OWN	-0.06	-0.03	0.04	0.04	0.06	0.05
HOS	-0.03	-0.05	-0.06	0.03	0.10	0.11
OTHER	-0.03	0.09	-0.01	0.03	0.03	0.05
JOB	-0.01	0.02	0.02	-0.04	-0.10	-0.01
TYPE*NEARBY	0.07	-0.05	-0.02	0.00	0.06	0.09
UFA	-0.15	-0.12	-0.19	0.13	0.13	0.13
NLIVE	-0.04	-0.07	0.20	-0.11	-0.07	-0.05
APP	-0.15	-0.10	-0.29	0.18	0.15	0.15
FLOOR	-0.08	0.01	-0.05	0.06	0.01	0.04
SEA	-0.10	-0.01	-0.11	0.13	0.11	0.14
MOUNT	-0.20	-0.07	-0.04	-0.03	0.00	-0.05
BED	0.12	0.05	0.26	-0.23	-0.19	-0.22
STUDY	0.15	0.10	0.31	-0.23	-0.18	-0.15
GEN	-0.06	-0.05	0.02	-0.06	-0.01	-0.04
DLIB	-0.07	-0.07	-0.18	0.09	0.07	0.08
ULIB	0.01	-0.08	-0.21	0.27	0.26	0.26
DCOM	-0.02	0.00	-0.15	0.00	-0.02	0.05
UCOM	-0.14	-0.03	-0.23	0.25	0.20	0.16
DYOU	0.03	0.02	-0.05	-0.08	-0.08	-0.04
UYOU	-0.14	-0.10	-0.18	0.30	0.28	0.19
DMTR	-0.09	-0.01	-0.07	0.07	0.06	0.04
DSPORT	-0.05	-0.04	-0.10	-0.05	0.02	-0.05
USPORT	-0.07	0.03	-0.14	0.19	0.20	0.24
DAMEN	0.00	0.05	0.04	-0.07	-0.03	-0.02
UAMEN	-0.05	0.06	-0.18	0.20	0.23	0.19
DPARK	0.05	0.04	0.00	-0.02	0.03	-0.04
UPARK	-0.09	-0.01	-0.17	0.26	0.24	0.24
DPRI	0.01	0.05	-0.08	-0.02	-0.05	-0.09
DSEC	-0.06	0.09	-0.08	0.03	0.05	-0.06
TRAF	1.00	0.28	0.26	0.00	-0.04	-0.05
SAFE	0.28	1.00	0.27	-0.04	-0.03	-0.04
DISTURB	0.26	0.27	1.00	-0.21	-0.20	-0.24
AWARE	0.00	-0.04	-0.21	1.00	0.67	0.62
PRIDE	-0.04	-0.03	-0.20	0.67	1.00	0.70
BELONG	-0.05	-0.04	-0.24	0.62	0.70	1.00

Appendix V

Summary of Results of Regression Model

Dependent Variable: CE
Method: Least Squares
Sample: 1 364
Included observations: 364

Variable	*Coefficient*	*t-statistic*	*p-value*
PUB_RENT	2.394121	0.637347	0.5243
PRI_OWN	3.325350	0.909088	0.3640
PRI_RENT	2.531055	0.657709	0.5112
PUB_OWN	1.755776	0.418190	0.6761
HOS	2.618007	0.704110	0.4819
JOB	3.431480	0.857056	0.3920
TYPE*NEARBY	-0.181664	-0.238511	0.8116
UFA	-0.006255	-1.220421	0.2232
NLIVE	0.444865	0.706041	0.4807
APP	0.056119	2.378573	0.0180
FLOOR	0.013412	0.389182	0.6974
SEA	0.097335	0.125510	0.9002
MOUNT	0.113388	0.203686	0.8387
BED	-1.376185	-2.162170	0.0313
STUDY	-0.360164	-0.571052	0.5684
GEN	1.178775	1.902583	0.0580
DLIB	-0.171279	-0.503092	0.6152

ULIB	0.644674	2.348091	0.0195
DCOM	-0.079983	-0.221041	0.8252
UCOM	0.930139	2.645868	0.0085
DYOU	-0.187787	-0.572055	0.5677
UYOU	0.885591	2.358455	0.0189
DMTR	0.223416	0.824038	0.4105
DSPORT	-0.085340	-0.224768	0.8223
USPORT	-0.134715	-0.600496	0.5486
DAMEN	0.320759	1.236397	0.2172
UAMEN	0.291110	0.924866	0.3557
DPARK	-0.195531	-0.637268	0.5244
UPARK	0.528745	2.213219	0.0276
DPRI	0.406135	1.620230	0.1061
DSEC	-0.264400	-0.944464	0.3456
TRAF	-0.368332	-1.426832	0.1546
SAFE	-0.079939	-0.305580	0.7601
DISTURB	-0.683903	-2.782880	0.0057
AWARE	0.726584	2.018908	0.0443
PRIDE	0.101222	0.251636	0.8015
BELONG	0.859102	2.420770	0.0160
C	1.868617	0.351914	0.7251

R-squared	0.565996	F-statistic	11.49041
Adjusted R-squared	0.516738	Prob(F-statistic)	0.000000
Durbin-Watson Statistic	1.827732		

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